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- Glowing Orbs
- Strings of Lights
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— What's Really Behind
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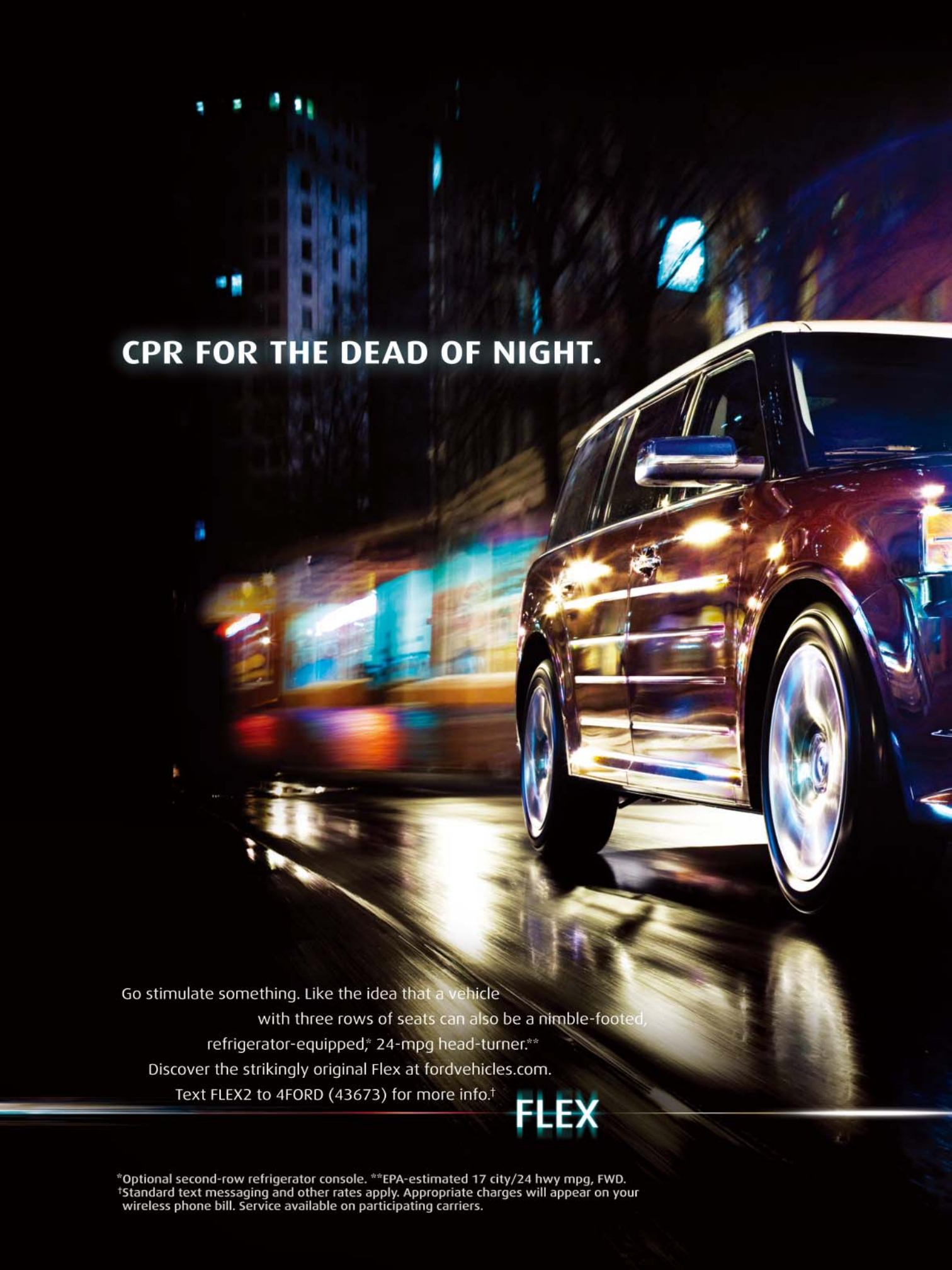
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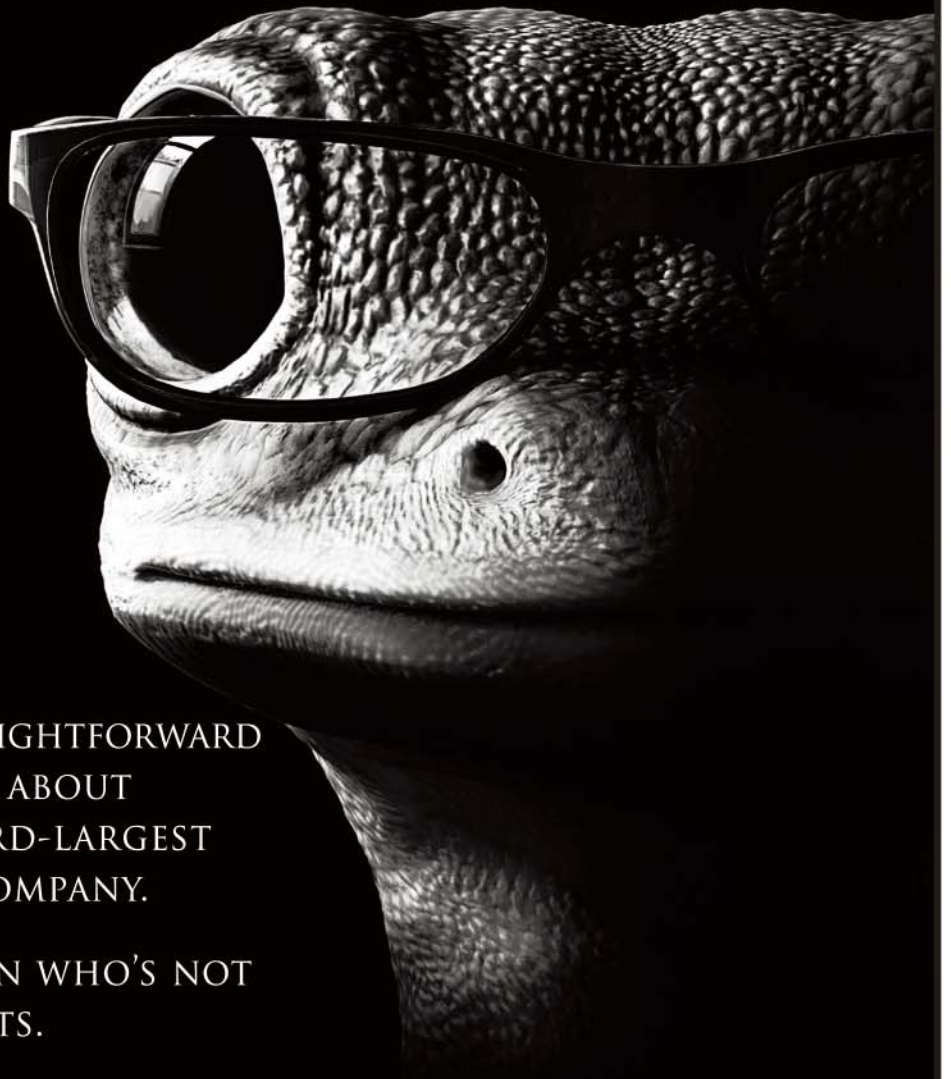
WHAT THEY'RE DOING

DR. KEN KAMLER

Surgeon, author of *Surviving the Extremes*

Ken Kamler travels high and low to do medical research. One current project is a U.S. Army-sponsored expedition to Mount Kilimanjaro to identify predictors of altitude sickness. The research will be used to identify soldiers who are predisposed to the condition before sending troops into the mountains of Afghanistan.





PRESENTING A STRAIGHTFORWARD
AND SERIOUS TALK ABOUT
THE NATION'S THIRD-LARGEST
CAR INSURANCE COMPANY.

FROM A SPOKESMAN WHO'S NOT
WEARING ANY PANTS.

Quite frankly, there's nothing I enjoy more than rolling up my sleeves and getting to work (though it should be noted I'm not in the habit of wearing shirts, either). After all, GEICO has been around for over 70 years — and that isn't simply a matter of luck. It takes dedication and skill to help people save hundreds of dollars on their car insurance. Of course, it also helps to be owned by Warren Buffett's Berkshire Hathaway Inc. So it should come as no surprise that S&P has consistently awarded GEICO an AAA rating for financial strength — its highest grade. Or that over 3 million drivers switched to GEICO last year. Clearly, when it comes to car insurance, I mean business. Even if the same can't be said of my attire.

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Why would people purchase a diesel vehicle and pay more for its fuel than can be offset by improved mileage?

CHARLES D. HENDRICKSON
FOREST LAKE, MN

EDITOR'S RESPONSE:

We agree that diesel fuel is overpriced in the U.S. See "America's To-Do List," page 42.

Signal Boost

January's "Improving In-Home Wi-Fi" hit on good ways to boost a wireless router's signal strength, but what about wireless devices like laptops and game systems? Once you've boosted your router signal, you can do the same for other wireless devices. Laptop adapters may have a power-save feature that you can disable to maximize wireless performance. And some adapters even have an external antenna.

MIKE KRUMMREY
ADA, MI



Have you built a one-of-a-kind project? **POPULAR MECHANICS** is accepting entries for our 2009 DIY Rally—anything from a handcrafted treehouse to a personal robot to an electric go-kart. (You must have already built it!) The best reader projects will be featured in the magazine. Submit yours by April 1, 2009: popularmechanics.com/DIYRally2009.

PM LETTERS

Digital Snoops

Your January story "Who's Tracking You," on privacy concerns, could have included more on GPS tracking devices. There should be a federal law restricting their use [in autos] without the registered vehicle owner's written consent. GPS equipment that [tracks] the owner's location is being sold across the country. George Orwell would say, "I warned you!"

MALCOLM JOHNSON
SEMINOLE, FL

Your story about the latest digital threats to privacy was enlightening. It's too bad so many efforts are required to fight back. Our last Congress let us down by passing a law granting retroactive immunity to [telecom companies] that had illegally spied on us. Hopefully the next administra-



ISSUE
01/09

Readers responded to our technology privacy report, hybrid vs. diesel comparison and tips to boost wireless range.

tion will demonstrate a higher appreciation for our rights.

TOM CICCATERI
ALBUQUERQUE, NM

Diesel Dilemma

I always find your auto reviews informative. But I must take issue with the idea (New Cars, Jan. '09) that more diesel autos should be in our future to reduce our dependence on oil through their improved mileage. I have a diesel pickup purchased in 2002, primarily for its towing capabilities, but at that time diesel was also the least expensive fuel. That changed in about 2003, and since then it has been the highest priced fuel.



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experts to give advice for the project you are working on right now. And while you are exchanging tips and ideas at myBuild, take the time to submit your DIY magnum opus to our 2009 DIY Rally, which exhibits the best projects that PM DIYers have to offer. To sign up for myBuild or the 2009 DIY Rally, go to popularmechanics.com/mybuild.



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TECHWATCH

Cosmic Point-and-Shoot

THE WORLD'S LARGEST DIGITAL CAMERA IS CURRENTLY AT WORK MONITORING THE UNIVERSE FOR SCIENCE—AND SELF DEFENSE.

BY JOE PAPPALARDO

→ **Astronomers in Hawaii** have built a working prototype of a system that uses the world's biggest digital camera to keep an eye on the universe. The University of Hawaii's mountaintop Panoramic Survey Telescope and Rapid Response System uses a small mirror to reflect images to the gigapixel camera. The prototype only has one mirror-camera pair; the proposed finished version will have four pairs. Pan-STARRS' main task is detecting dangerous asteroids: Every night the telescope takes a thousand photos of the sky; an automated system scans the resultant black-and-white images for any movement that could indicate a planet killer. The telescope will also produce ultra-high-resolution color images to create the most-comprehensive-ever survey of the universe.



Gigapixel Camera

M51 and Its Companion Galaxy, NGC 5195

Interstellar Photography

+ A quartet of the world's largest digital cameras will catalog up to a billion galaxies outside the Milky Way. The images will be 38,000 by 38,000 pixels in size—roughly 150 times larger than

resolutions of point-and-shoot digital cameras. Each camera will have 1.4 billion pixels. Using one camera, a prototype telescope took its first usable image in late 2008.





FLIPPER'S SECRET POWER

+ Scientists have long wondered how dolphins can swim as fast as 25 mph, given the thickness of their tail muscles and the density of water. But researchers in Troy, N.Y., were shocked to see the animal's power when they tracked the movement of tiny air bubbles in the water around swimming dolphins. Each tail flip generates about 200 pounds of thrust—triple Michael Phelps's best.



You Can't Make an Airplane Without Breaking Some Wings

Boeing's new 787 Dreamliner is revolutionary because it uses carbon composite materials in more structural parts than any previous commercial jetliner. But how tough is this new material? To find out, company engineers shattered a 50-ft.-long, 55,000-pound structure called the wing box, which connects the wings to the fuselage. The test showed that the box could withstand more than 1.5 times the highest aerodynamic load the jet could ever experience. After delays, the first Dreamliners are currently scheduled for delivery in early 2010.

BIG MOTORS FOR MINI TOOLS

+ Engineers in Switzerland are producing a miniature electric motor that they say is the first to achieve a speed of one million revolutions per minute, four times faster than the previous spin master. The matchbox-size, 100-watt motor integrates mini ball bearings and electrical components in a special titanium shell that can withstand the extreme centrifugal forces created by the record-breaking speed. The system may be used in drills and milling machines designed for small electronics.

NEWSBRIEFS

Reports From the Edge of Science

Compiled by Alex Hutchinson

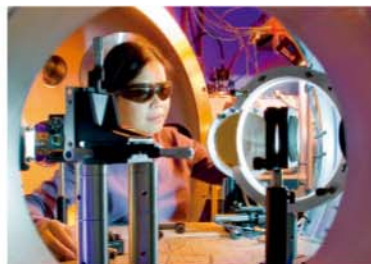


Time Tweak Saves Energy

+ Since 2007, daylight saving time has started three weeks earlier (in March) and ended one week later (in November) each year, in a governmental bid to save energy. The first-year results are now in—and it worked. According to the Department of Energy, the measure reduced U.S. energy consumption by 17 trillion Btu, enough to power 175,000 households for a year. Most savings resulted from slightly lower electricity use in the early evening. Southern states saw lesser savings, possibly because they were offset by more air-conditioner use.

E-MAIL FROM MAJOR TOM

+ This summer, astronauts on the International Space Station will test a new "Interplanetary Internet" scheme that last year swapped information with a spacecraft more than 20 million miles from Earth. The system relies on relays, with each node storing information until it can be forwarded safely. This safeguards data despite interruptions by solar wind or planets.



Perfect Recipe for Antimatter

+ Physicists at Lawrence Livermore National Laboratory have developed a cheap way to produce copious amounts of elusive antimatter. By shooting short, powerful laser bursts at a small gold target, they are able to generate positrons, the antimatter version of electrons. Similar methods have been explored before, but by using a thicker piece of gold, the physicists created an estimated 100 billion short-lived positrons. The researchers will use the method to study black holes and other natural antimatter creators.



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Making the Space Station a Home

PREPPING THE INTERNATIONAL SPACE STATION FOR A LARGER CREW IS THE ULTIMATE IN HIGH-END HOME REMODELING.
BY JOE PAPPALARDO

→ It takes some planning to prepare a small space for new roommates, especially if the apartment is 220 miles above the planet. NASA engineers have been developing space-ready versions of familiar fixtures to prepare for an expansion of the International Space Station's crew, which this year will double to six. Engineers must build household items that balance space, power consumption, weight and repairability. "Those tradeoffs were made at the very beginning [of the gear's design]," says Marybeth Edeen, who heads vehicle hardware development for NASA's ISS program. The systems that rely on chemistry and fluid dynamics, such as plumbing, are tougher to develop than a new bedroom. "In microgravity, solids don't go down and gas bubbles don't go up," she says. "Everything just goes where it wants." These pieces of orbital home design, most delivered in a single space shuttle trip late last year, provide a realistic glimpse of what it's like to live in space.



Orbital Renovation

Kitchen

The crew's galley has to be expanded; new items include suitcase-shape warmers that gently close around as many as 12 metallic foil bags holding prepared foods. The sink, based on the space shuttle's, has its own hot-water heater for bags of stew or cups of instant coffee.

Exercise Equipment

The Advanced Resistive Exercise Device uses vacuum canisters and ropes to create resistance that mimics weights. The ARED provides the equivalent of 600 pounds of weights that can be used for dozens of exercises. Astronauts' muscles and nerves can



Galley

deteriorate if they don't work out.

Bedroom

ISS residents each have individual 3 x 3.5 x 6-ft quarters with



Resistive Exerciser

laptop connections. "They're living in a closet," Edeen says. "And it's not a walk-in." Astronauts have just enough space to dress.



Bathroom

Bathroom

The ISS received a new toilet that NASA purchased from Russia. A gentle vacuum pulls waste into a funnel that leads to a



Water Recycler

solid-liquid separator. Urine gets converted into clean water in a recycling system. Water quality is tested in space and on the ground.

WHAT IT TAKES TO LIVE IN THE ISS, PER PERSON

• O₂: 2 pounds daily • WATER TO MAKE OXYGEN: 0.26 gal daily • WATER FOR HYGIENE AND DRINKING: 0.8 gal daily



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Sanguine Science

AS DONOR SUPPLIES REMAIN CRITICAL, NEW "PHARMING" TECHNOLOGIES COULD CREATE BLOOD ON DEMAND. BY MICHAEL MILSTEIN

→ **Our bodies manufacture** lots of blood—about 1.5 ounces of red blood cells daily—but the nation's hospitals remain in desperately short supply. The need for blood for soldiers in war zones is even more dire, as donated blood airlifted from the U.S. can take more than three weeks to get to the front lines. To address this shortfall, the Defense Department's advanced project agency, DARPA, has commissioned a medical company to build a fully automated machine able to make new blood on-site—which would also be a welcome development for civilian hospitals. Cleveland-based Arteriocyte received nearly \$2 million to perfect a "blood pharming" system that grows red blood cells in a three-dimensional matrix of nanofibers that replicates bone marrow.

Company researchers trying to grow stem cells noticed that, by tweaking the temperature and concentration of oxygen and carbon dioxide that is pumped through the culture, they could also create early versions of red blood cells. The proposed system, the size of a few household refrigerators, would weekly churn out about 100 units (7.5 ounces each) of universal-donor type O-negative blood.



DARPA wants its blood pharming tech to get FDA approval in three years.



+ More Tech to Ease the Blood-Supply Crisis

Secure a Safe Supply

+ Contracting disease is a constant concern for recipients of blood transfusions, but Colorado-based CaridianBCT has started clinical trials for a system that uses ultraviolet light and vitamin B-2 to zap viruses, bacteria and parasites in donated blood.

Make Donating Less Painful

+ Memphis-based Luminetx's VeinViewer could make taking blood and inserting IVs easier by finding veins with infrared light. When the \$30,000 system shines IR light on an arm, tissue reflects the light while veins do not. An image of the veins is then projected onto the donor's arm.

Every Drop Counts

+ The U.S. government has created a laser system that can detect a single blood-borne virus or other antigen amid a quadrillion other molecules. The system locates antigens by exposing them to antibodies, which bond to the bugs and change their reaction to electric fields created by lasers.



Time
Machine
JULY 1967



Today's special operations boats owe their legacy to small gunboats of the past.

In 1967, PM illuminated the experiences of Vietnam Swift boat skippers with a first-person account from Lt. J.G. Jim Stephens. For days at a time, his crew spent hours "patrolling down the coastline, checking out 30-ft Vietnamese fishing boats" and engaging in firefights with enemies on shore. Today's black-op boats (see "Smoke on the Water," page 78) do not patrol but instead deliver and extract Special Forces. Commanders say the crews in Iraq have been involved in the largest riverine gunfights since Vietnam, and some tactics and weapons are holdovers from that war. Every year, special ops boat crews host a reunion for their Vietnam-era trailblazers. — Allie Haake

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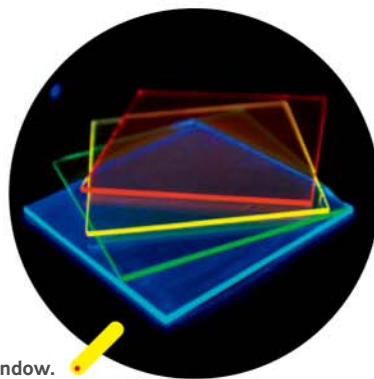
THE COLORS OF CLEAN POWER

A new upgrade for photovoltaic cells could make solar power a cheaper energy alternative.

BY AMBER FIELDS

Within a decade, windows may provide more than just a view—they could generate electricity. A group of MIT researchers has formed a company to market color-coated glass or plastic plates with solar cells around the edges that they say could increase the efficiency of existing solar panels by as much as 50 percent. The Organic Solar Concentrator prevents light from being wasted by guiding photons with organic-dye-tinted plates, layered so that each subsequent plate absorbs a longer wavelength. The dyes direct some photons to solar cells at the edges, while light at longer wavelengths continues to the next pane. The company, Covalent Solar, hopes to sell the panels within three years, but has to perfect dyes that remain stable for more than a few months. If it succeeds, stand-alone panels could be passé—and your living room skylight might pay for itself.

Today's solar concentrators turn to track the sun; tomorrow's could fit in a window.



Fluid Situation

A PM PANEL HIGHLIGHTS THE CHALLENGES A THIRSTY NATION MUST FACE.

→ As the new president takes office promising hundreds of billions in infrastructure spending, water systems should be a priority, according to a panel on conservation convened by POPULAR MECHANICS in November. Smart policies require accurate information: Here are insights gleaned from the discussion. (For PM's suggestions for the new administration, see "America's To-Do List," page 42.)



Tech that saves water includes an inland desalinization plant in Texas (above), a green roof in Chicago and front-loading washing machines.



1
It's an energy problem.

2
Global warming isn't just about droughts in the Southwest.

3
We may need desalination.

→ An American home uses three times as much water to generate electricity as it sends down its drains, said William Horak, who leads Brookhaven National Laboratory's energy-water research initiative. Water-cooled power plants withdraw up to 50,000 gal for each megawatt-hour produced. Air-cooled power plants are far more water-efficient, using only around 600 gal per megawatt-hour.

→ Climate models predict more intense storms, said panelist Joan Rose, the co-director of the Center for Water Sciences at Michigan State University. Heavy precipitation can overload drainage and sewage systems. Researchers estimate that up to 20 percent more untreated sewage will enter the Great Lakes as the climate warms. Steps such as porous concrete, green roofs and improved sewer design can help.

→ Desalination takes a huge amount of energy, but so does transporting fresh water, said Mark Shannon, the director of the Center of Advanced Materials for Purification of Water with Systems. Desalination is usually for coastal regions. But El Paso, Texas, now runs the world's biggest inland desalination plant to treat brackish supplies. In Florida, rising sea levels could contaminate groundwater, also requiring desalination.

ON THE WEB → For more details about the water panel and other PM conferences, go to popularmechanics.com.

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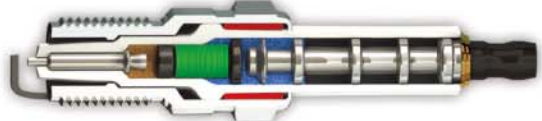
Actually, it's called a pulse plug—here's why its technology should be in your engine.

Until now, every gallon of gas you bought was ignited by a simple spark plug—an outmoded technology that has barely changed in 100 years. But now you can change to a new eco-friendly pulse plug that uses an advanced technology to make every drop of gas burn better and cleaner.

This new technology—with its eight patents—is based on plasma research supported by the world famous Sandia National Laboratories—and yes, that's *definitely* rocket science.



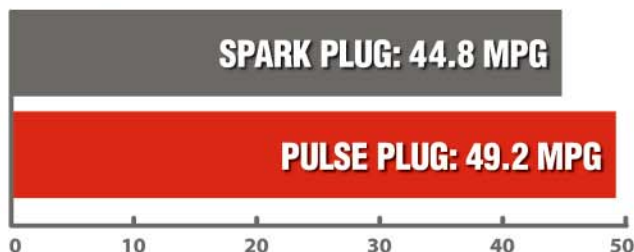
See the difference in technology: compare the cross section of a typical spark plug above, with that of the new pulse plug below.



Here's how it works: electrical energy from the engine's power coil is stored in the pulse plug's built-in capacitor. At the exact moment needed, that energy is released in an amazingly quick (two nanosecond), powerful, high-energy pulse.

The result: the improved combustion efficiency burns fuel sooner and more effectively, which means better fuel mileage, less CO₂ based emissions, and better overall drivability. For example, here is the result of a recent, highly-controlled fuel consumption lab test:

2007 Toyota Prius



Test results:

- 4.4 more MPG
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UPGRADE



Liquid cooling replaces noisy fans.

VoodooDNA

A laptop-like external power supply saves space and prevents overheating.

Game-Frame Computer

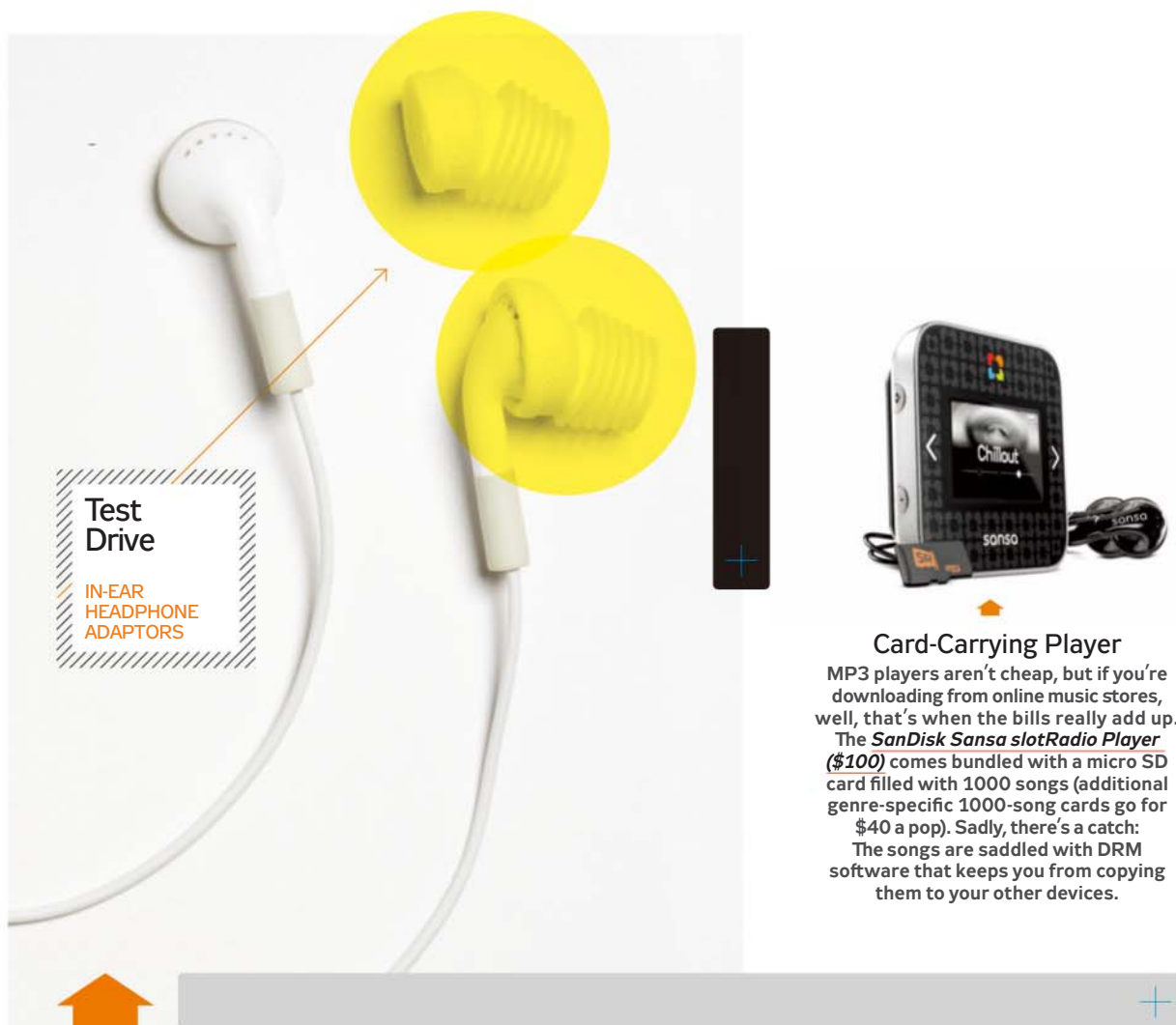
Gamers who want turbocharged machines are used to making tradeoffs—power typically comes at the expense of price and portability.

The **HP Firebird with VoodooDNA**, which starts at \$1799, is small enough to tote to LAN parties (its chassis is about a quarter the size of its predecessor's), but powerful enough for fast-paced fragging (three graphics cards ensure rapid-fire rendering). The secret: a creative mixture of desktop and high-powered laptop-size components. — **SETH PORGES**



The side of the case swings open for easy access to upgradable components.





Test Drive

IN-EAR
HEADPHONE
ADAPTORS

Card-Carrying Player

MP3 players aren't cheap, but if you're downloading from online music stores, well, that's when the bills really add up.

The **SanDisk Sansa slotRadio Player (\$100)** comes bundled with a micro SD card filled with 1000 songs (additional genre-specific 1000-song cards go for \$40 a pop). Sadly, there's a catch:

The songs are saddled with DRM software that keeps you from copying them to your other devices.

Because in-ear headphones block external sound, users don't need to crank up the volume to hear their music over noisy surroundings. But a decent pair can be costly, typically running \$100 or more. The **Acoustibuds Earphone Adaptors (\$13)** are a cheaper means to the same end. These silicone adaptors snap onto the end of almost any ear bud, frankensteining it into an in-ear headphone. In tests they were surprisingly comfortable, did a fine job of blocking outside noise and kept our slip-prone buds situated firmly in our ears.



Most voltage detectors speak in binary language—they let users know if there's a current or not but don't divulge how much juice there is. The noncontact **Greenlee Adjustable Voltage Detector (\$17)** features an adjustable dial that allows users to tune its sensitivity from as low as 5 volts to as high as 1000 volts (a range that far exceeds the single setting on most voltage detectors).



What will you build?™



CG Utility



CG Framar



CG Padded Palm



CG Impact Pro



CG Super Duty



HW Utility



HW Padded Palm



HW Impact Pro

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Abusive Lab Test

MULTIUSE
TAPES

Duct tape's versatility is almost a cliché—we've seen it used for everything from wallet construction to hull repair to, well, patching ducts. But can it beat newfangled multiuse

tapes? We pit the standby against three challengers, testing each tape's tensile strength, the tenacity of its adhesive and how it worked after a week underwater. —HARRY SAWYERS



SCOTCH MULTI-USE DUCT TAPE

"For repairs in and around the house." \$10 for 60 yd

+ **Sturdiness**

We were able to stack 45 pounds of dumbbells on a length of tape before it broke.

+ **Stickiness**

Held a bundle of four 12-gauge Romex electrical wires against a wall for a full week.

+ **Water Resistance**

Water slightly loosened the tape's grip on PVC and copper pipe, but it stuck well where it was wrapped around itself.



SCOTCH TRANSPARENT DUCT TAPE

"Lasts six times longer than other heavy-duty tapes." \$6 for 20 yd

+ **Sturdiness**

Broke under 35 pounds of weight.

+ **Stickiness**

Our test bundle of wire fell from the drywall on the first night.

+ **Water Resistance**

Water did little to hurt an already lackluster grip. It was far too easy to peel the tape off of copper and PVC bundles in both wet and dry conditions.

How We Tested Sturdiness: Stacked dumbbells on a tape sling until it snapped. Stickiness: Stuck a bundle of four 12-gauge wires against drywall for a week. Water resistance: Submerged a bundle of tape-wrapped pipes for a week.

Bottom Line: Although duct tape proved capable, the clear winner was Gorilla Tape, which handily won all our tests.



NASHUA WATER-PROOFING TAPE

"Forms an instant water-proof bond." \$9 for 11 yd

+ **Sturdiness**

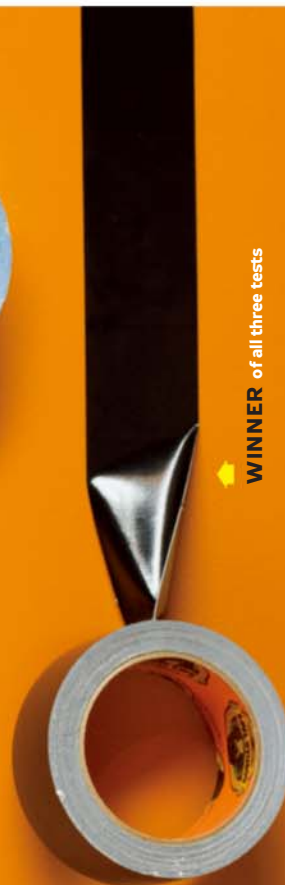
Nashua turned in the weakest showing: 15 pounds caused the tape to snap.

+ **Stickiness**

Held the wires for a week without budging.

+ **Water Resistance**

The bond survived the drown test, but for some reason this one tape was a breeding ground for slime—it became covered with a vile, furry growth after a single night.



GORILLA TAPE

"For the toughest jobs on planet Earth." \$9 for 12 yd

+ **Sturdiness**

The test's champ: It took 85 pounds to break the Gorilla's back. Yet it still tore easily by hand, making for easy application.

+ **Stickiness**

The ape held its wires in place for a week—then showed off by pinning a 3-pound dumbbell to the wall over the weekend.

+ **Water Resistance**

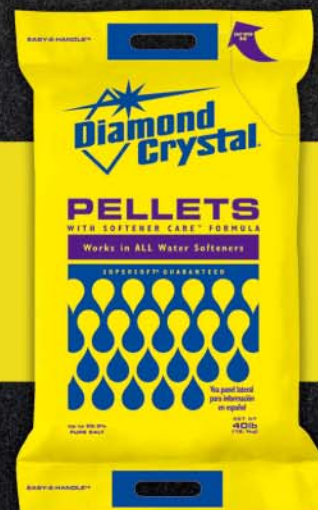
Overall stickiness was not compromised by a week in the drink.

WINNER of all three tests



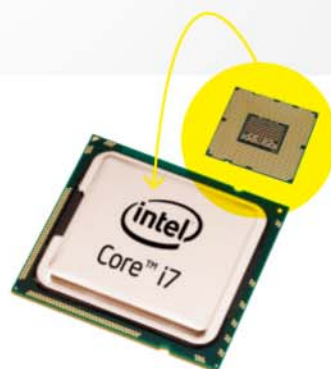
Don't turn a trip into a trek.

The unique two-handle bag for water conditioning from Diamond Crystal® Pellets. An easy-to-carry innovation that's good for your family and easier on your back. Learn more about how Diamond Crystal makes it easy to give your family clean, soft water by visiting us at www.diamondcrystalsalt.com.





The **Yamaha FZR WaveRunner (\$12,600)** is designed for one thing: extreme speed. It's the quickest, most powerful personal watercraft on the market (it pulls 0 to 30 in 1.5 seconds, thanks to the industry's only 1812 cc four-stroke engine), and it's the first with telescoping handlebars, allowing riders to stand comfortably for high-speed bursts, then hunch down for sharp turns.



Test
Drive

WIRELESS
CHARGING



The **Psyclone TouchCharge Kit (\$50 to \$70)** purports to charge gaming controllers (Xbox 360, PS3 and Wii versions are available) without bothersome wires—lay a controller on a conductive metal pad (included) and it receives juice via a clamp-on battery adaptor. In practice, it worked as promised.

And even though the adaptor added a bit of bulk, game controllers are not mobile devices that frequently fill pockets—so the bulge didn't bother us. Still, the best may be yet to come: The company behind the tech told us that it plans on building wire-free charging directly into gadgets and tabletops. We can't wait.

Yes, the new *Intel Core i7* is the fastest PC processor around (Intel claims it's 40 percent faster than its predecessors)—but no chip ever holds that title for long.

What's really interesting is that the speed boost was accomplished without increasing energy consumption. Similar technology could yield benefits for all kinds of gadget-powering chips down the line.



There's something that just doesn't sit right about the new breed of "compact" 18-volt lithium-ion drills, which have a smaller and lighter battery. Take the *Hitachi DS18DSAL Compact Pro Driver Drill* (\$190). While its full-size 18-volt cousin aced our recent drill-driver test, this drill's battery life and power were lacking (a problem that plagues similar tools from other manufacturers). If size is important, we suggest sticking to 10.8- and 12-volt drivers that can slip into a tool belt.



Most portable rechargeable batteries allow you to refill the juice on only one gadget at a time. The *Callpod Fueltank* (\$70) doesn't force the user to pick favorites—it has two jacks for simultaneous charging (and the manufacturer sells plug attachments for virtually every gadget). Though our tests found its battery life to fall slightly short of the promised seven full phone charges, we were still able to pull several cycles before it needed a fill-up.



The *Duracell Powerpack 450* (\$120) generator is best thought of as an insurance policy: Insurance against a dead car battery (it provides audio directions on jumpstarting your car), insurance against flat tires (it includes a 150-psi air compressor) and insurance against emergencies and even boredom (its AC, DC and USB outlets can charge laptops, GPS units and cellphones).



✓Yes



✓Yes



✓Yes



xNo



✓Yes



✓Yes



✓Yes



✓Yes



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2009 Nissan 370Z

Base Price: \$30,000

Zip Drive

Onlookers at a Malibu, Calif., gas station instantly noticed our new Z. It's sharp and the interior is much improved. Gone is that hard, frugal feel to the surfaces. Now it's all properly textured and cushioned, covered and colored. Yet it's the fairly profound mechanical updates that pique our interest. The new 332-hp 3.7-liter V6 packs enough torque to pull responsively from 2000 rpm on up into sixth gear. So one need not always downshift, or venture near the tachometer redline, to pass a semi. But when you do, there's a vivid rush of power. The six-speed manual now boasts downshift rev matching. Yes, the engine management system will blip the throttle so engine revs match wheel speed—it's like your personal heel-toe downshift butler. —BARRY WINFIELD

→ Nissan 370Z | Lexus RX350/450h | Toyota iQ | Mercedes-Benz A 170 | Porsche Cayman |
Pontiac G8 GXP | Harley-Davidson XR 1200 | Honda Insight | Mustang GT | Mazda3 X

PM TEST
DRIVEN

→ Nissan 370Z | Lexus RX350/450h | Toyota iQ | Mercedes-Benz A 170 | Porsche Cayman
Pontiac G8 GXP | Harley-Davidson XR 1200 | Honda Insight | Mustang GT | Mazda3 X



2010 Lexus RX350/450h

Haptic Hybrid

The multimedia interface system in the new Lexus RX is intuitive and cunningly equipped with a computer-mouse-like haptic feedback device that greatly improves user accuracy. You can now talk to the voice recognition system in plain language, too. For example, a phrase like "it's too hot in here" deftly leads to the temperature prompt. Even in the predecessor to one of the most refined crossovers on the market, there were ongoing struggles against unwanted noise—the new RX is dead quiet. With so little distraction, the mellifluous tones of the 275-hp V6 can be enjoyed at full song. Or you can listen to the amazing 330-watt, 15-speaker Mark Levinson system—and have the whole New York Philharmonic sitting around you. The RX450h hybrid delivers 295 hp and returns 28 mpg city and 27 highway. Driving around the peaceful environs of Napa Valley, Calif., was more vacation than work day. And, isn't that what driving a Lexus is all about? —BARRY WINFIELD



2010 Toyota iQ

Intelligent Design

The Toyota iQ is clever. No, scratch that. It's got Ivy League intelligence. That's the only way to describe a car that's so small (9 ft 9.5 in. long), so inexpensive (around \$13,000) and so positively packed with innovation. An ultraskinny 4.7-in.-thick fuel tank sits under the floor to save room. And the tiny climate control unit uses a thinner fan to reduce noise. This allows the dashboard to be asymmetric, which in turn yields more interior space. Glove box? Who needs it? The Euro- and Japan-only iQ has an optional canvas bag that pops onto the dash. The 91-hp 1.0-liter three-cylinder is tipped forward, away from the driver, to maximize cabin space—and it roars mightily as you pull away into Milan's notoriously heavy traffic. The car's diminutive size means the 1973-pound iQ feels quicker than it is. Even the so-hip-it-hurts fashionistas gave the iQ a double take through their sunglasses. On the autostrada, the iQ showed that it's stable, refined and comfortable even at 90 mph. But it's the 54.7 mpg that's the real payoff. —ANDREW ENGLISH

Toyota's hip microcar has an interior as clean and as straightforward as the exterior. We hear it may arrive here next year as a Scion—and that could mean a customizable interior too.



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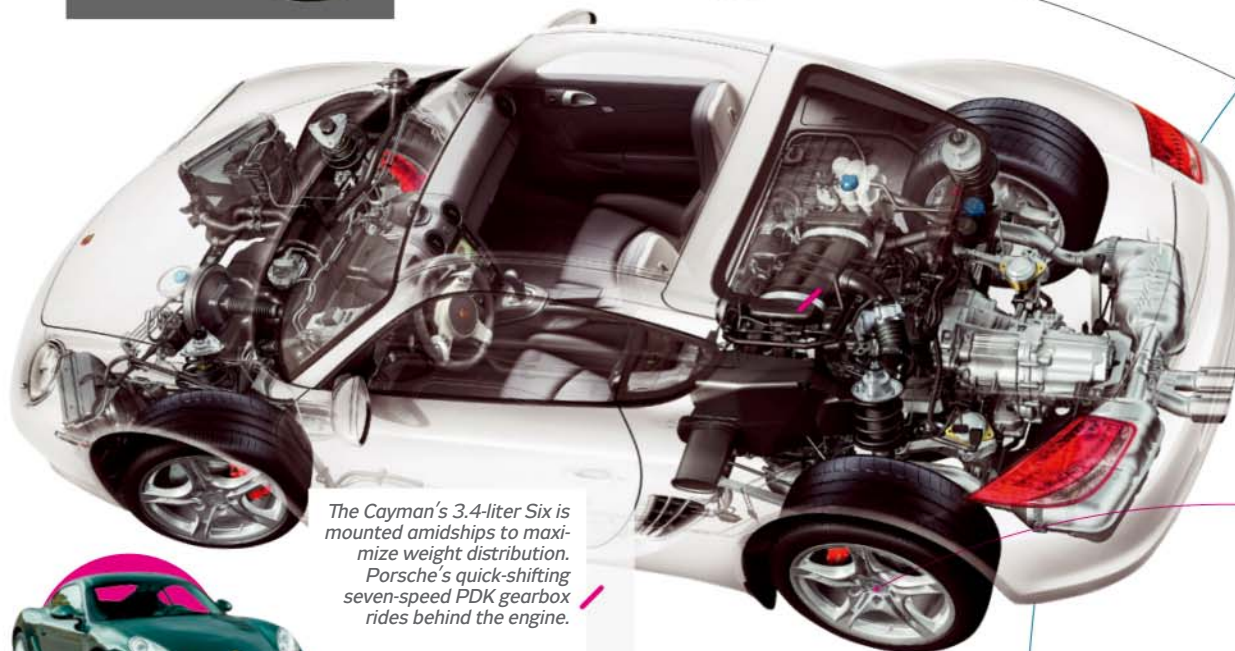
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2009 Mercedes-Benz A 170 + Baby Benz

In Europe, the A-Class is the tiniest Mercedes-Benz you can get. To see what we're missing, we drove a new A 170 more than 1000 miles throughout Germany, traveling from Frankfurt to Munich, Ingolstadt and Stuttgart—and back. Ours paired the 116-hp 1.7-liter four-cylinder engine with a CVT. The A-Class is shorter than a Mazda Miata, but despite its small footprint, climbing into the A 170 sedan reveals a surprising amount of

space. Click the shifter into "D" and the engine pulls smoothly—if modestly—as revs rise. Our fuel economy varied wildly. At its best, we eked out 39 mpg. But with the gas pedal pegged during top-speed driving, our average dropped to 24 mpg. Speaking of top speeds, in the triple digits, the A 170 felt impressively secure and planted to the road. Hey, if it's good enough for the autobahn, it should be good enough for America. —BASEM WASEF



The Cayman's 3.4-liter Six is mounted amidships to maximize weight distribution. Porsche's quick-shifting seven-speed PDK gearbox rides behind the engine.



2009 Porsche Cayman

The Good Life

A tinkle of rain dapples the windshield of the new \$60,000 Cayman S as I mash the throttle entering the motorway in Cádiz, Spain. The 3.4-liter Six is now armed with direct fuel injection so it's up 25 hp over last year. Plus there are bigger brake discs and wider wheels too. Armed with these tools, we press on. Construction mud, slimed by the light rain, keeps the tires on the edge of wheelspin through the first three gears.

Despite this greasy pavement, the stability control keeps her tracking straight, and the brilliant seven-speed PDK encourages running flat out—at least until good judgment and the fear of arrest by the Guardia Civil make discretion overtake valor. This sure beats the office. —MIKE ALLEN



2009 Pontiac G8 GXP + OLD-SCHOOL MUSCLE

Pontiac stuffed the 6.2-liter LS3 Corvette motor into the G8 to create the \$39,995 GXP—and it's a real muscle sedan. The LS3 puts out 402 hp—good for 60 mph in 4.7 seconds. The moment you wrap your hands around the beefy leather-wrapped wheel, slot the manual-shift lever into first and hit the street, you feel a rush of 1960s déjà vu courtesy of the rumbling exhaust, firm ride and big torque. Fortunately, your trip back to the '60s ends as soon as you point the GXP at the first turn of a tight and twisty road. This one handles—and delivers 20 mpg highway too. —PATRICK C. PATERNIE

PM TEST
DRIVEN

→ Nissan 370Z | Lexus RX350/450h | Toyota iQ | Mercedes-Benz A 170 | Porsche Cayman
Pontiac G8 GXP | Harley-Davidson XR 1200 | Honda Insight | Mustang GT | Mazda3 X



TESTED:
Insight vs. Prius



2009 Harley-Davidson
XR 1200

Flat Tracker

Few motorsports are more definitively American than flat-track racing—and Harley's 580-pound XR1200 is an homage to the sport. It packs a 90-hp version of the Sportster's 1200 cc V-twin and a more aggressive suspension. Climb aboard and you just might feel a bit nostalgic. Firing up this bike produces a familiar Harley snarl, and the engine's vibrations remind you this isn't an over-engineered superbike. Slowly let out the clutch, twist the throttle and the \$10,799 XR1200 accelerates with authority. It's a surprisingly comfortable place to spend several hours. This Hog may not be the nimblest bike on the road, but it's certainly fun to ride on twisty tarmac.

— BASEM WASEF



The Insight's EcoGuide glows blue when you accelerate and slowly changes to green as you ease off the gas to maximize fuel economy.



2009 Honda Insight

Smart Moves

The original Insight wasn't a sales success. The reason? Too few doors. But it's back, wearing more practical, five-door duds. This is one hybrid that's actually fun to drive. Electric power comes from a 13-hp motor sandwiched between the engine and CVT. That motor assists the 88-hp 1.3-liter gas engine. A 0.6-kilowatt-hour nickel-metal-hydride battery pack resides in a well between the rear wheels—saving valuable trunk space. The steering feels natural and the low-rolling-resistance tires offer reasonable grip and response. We also dig the Insight's EcoGuide, which can score drivers on their frugal right foot. Honda expects the Insight to return 40 mpg city and 43 highway. Some of the interior surfaces, like the rock-hard optional center armrest, feel a little low-rent. But most of the car outperforms its \$20,000 price. The cabin is roomy and quiet; the folding rear seats combine with the hatchback to offer 31.5 cu ft of space. This Insight is poised to give the Prius some serious competition. — LARRY WEBSTER

Let's see how these hybrid rivals stack up. The Prius has a longer wheelbase, which provides more rear legroom. But both hit 60 mph in about 10.5 seconds and stop from that speed in roughly 127 ft. At 48 mpg city and 45 mpg highway, the Prius has the edge in EPA fuel-economy figures, but after 200 miles around Phoenix, the Insight delivered 42.4 mpg compared to 41.1 for the Prius. The Insight feels sportier and it'll be a few grand cheaper too. **The Insight wins—this time.** An all-new Prius is just around the corner. — L.W.

2010 Mustang GT + Rebirth of the Cool

The new Mustang may look a bit like the old one, but from the driver's seat you can feel the difference. The V6 model remains largely unchanged under the hood. But the 4.6-liter V8 in the \$27,995 GT benefits from a ram-air intake system that boosts hp to 315 and is paired to a five-speed manual or automatic. Hop in and you notice the tighter interior panel fit, especially the soft, molded instrument panel. It's quieter too. So quiet, that signature V8 rumble is actually piped into the cabin via a tube from the new cold-air intake. Engineers tuned out the jittery rear-end motions caused by rough pavement, and the steering has a heftier, more direct feel. Even on 19-in. wheels, the ride is compliant. Tackling the tight, twisty roller-coaster Streets of Willow race circuit in Rosamond, Calif., demonstrated the benefits of the 3.73 rear axle and the Track Pack over the standard setup. The extra mechanical advantage from the higher gear ratio **adds up to more fun.** And in a Mustang, fun is what matters most. —PATRICK C. PATERNIE



The body may be new, but as before, the Mustang is available as a coupe, a glass-roof coupe or our springtime favorite—a full convertible.



2010 Mazda3 + Head of the Class

The Mazda3 is simply the most entertaining car in its class and has the refinement to match. Engineers doubled the percentage by weight of high-strength steel. That lowered the structure's weight by 24 pounds and increased bending rigidity. The interior of any car is as much a part of the driving experience as the chassis. And the soft-touch plastic here feels expensive. Even the base 148-hp model equipped with a five-speed manual is eager, with a delightfully accurate shifter. The 2900-pound Mazda attacked the curves of L.A.'s Topanga Canyon with surprising tenacity, hanging on long past the point where we expected it to drift. The 167-hp 2.5-liter version is much the same—except everything happens quicker. It is remarkably smooth, and the steering provides plenty of feedback without heavy effort. Not bad for around \$20,000. —L.W.

PM TEST
DRIVEN

→ Nissan 370Z | Lexus RX350/450h | Toyota iQ | Mercedes-Benz A 170 | Porsche Cayman |
Pontiac G8 GXP | Harley-Davidson XR 1200 | Honda Insight | **Mustang GT** | **Mazda3** X

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In the 1930s, engineer, mechanic and driver Ab Jenkins set endurance-race records in this streamlined and sponsor-decal-free Mormon Meteor III.

SPIRIT OF THE SALT

> BY JAY LENO

> PHOTOGRAPHS BY JOHN LAMM

D

LONG BEFORE
MEGASPONSORS,
ENDURANCE
RACING PIONEER
AB JENKINS
RACED FOR LOVE
OF THE SPORT.

David Abbott "Ab" Jenkins was one of America's least known motorsports heroes. He spent years setting long-distance speed records on the Bonneville Salt Flats, beginning back in 1932. That was decades before the Southern California Timing Association, which runs today's Bonneville Speed Week, sanctioned racing there. Ab was a motorsports pioneer.

In the early years, Bonneville had a 10-mile circular track, so racers could run 12, 24 or even 48 hours—stopping only to refuel. There wasn't much sponsorship in those days. If you got a case of motor oil it was like, "Hey, I got some free oil!" Years ago, an average guy could build a land-speed car in his garage and go set a record.

Like other racers of his era, Ab raced for the love of the sport—he did it all himself. Not only was he the driver, but he had to be the engineer, the R&D guy—and he had to build the car too. He knew when it broke, knew when it was running perfectly, and he could drive it for 24 hours straight at 160 mph.

Ab had that great all-American-boy stuff of the 1930s. Today we have kids who are almost inherently computer whizzes. In Ab's day, there was a generation of boys who were mechanically adept.

Almost from birth, they could pick up something and go, "This is off by a few thousandths of an inch here." Ab wanted to be a good role model for those kids. So he always drank milk. He didn't touch liquor, caffeine or drugs. Ab Jenkins was a Mormon, and his car was aptly named the Mormon Meteor.

Ab's Mormon Meteor ties together two great elements of American automotive history: Bonneville and the Duesenberg brothers. Ab's Meteor, a 1935 Duesenberg Special, had a streamlined body and a supercharged 420-cu-in. straight Eight that developed around 400 hp. On his third attempt in the Mormon Meteor, Ab beat British racer John Cobb's record, averaging 135.58 mph for 24 hours.

Of course, Ab wanted to go even faster, so he got a Curtiss Conquerer aircraft engine—a 1570-cu-in. V12 that put out 750 hp. Augie

Duesenberg designed a new bell-housing and flywheel to replace the old propeller drive. Working with Ab's son, Marvin, Augie oversaw the V12's installation. They changed the car's name to the Mormon Meteor II. And in the summer of 1936, Ab averaged 164.47 mph for 500 kilometers (about 310 miles), breaking the record of British driver George Eyston. With Babe Stapp as his relief driver, Ab averaged 153.82 mph for 24 hours, and stayed in the car to do 148.64 mph for an amazing 48 hours. In 1937, with Indy winner Louis Meyer co-driving, Ab averaged 157.27 mph over 3700 miles in the Meteor to break his own record.

But the Curtiss V12 was too heavy for the Duesenberg chassis and the car understeered at high speeds, so Ab had Augie design a new chassis. This car became the more streamlined Mormon Meteor III. In those days, streamlining was whatever you thought it was. Nobody was testing in wind tunnels. It was all just common-

sense engineering. The Meteor III's body was offset 6 in. on its chassis, because the records were run in huge circles for hours and hours. Imagine driving in a circle for 24 hours straight at over 170 mph. People get exhausted today driving from Los Angeles to San Francisco with the air conditioner and all the other stuff on.

In July 1939 Ab had been running the Meteor III with a huge tail fin for added stability for 3 hours at over 171 mph. Suddenly, a fire caused by an overfilled fuel tank engulfed the car. Locked in the cockpit, Ab was rescued by Marvin, who pried off the canopy. Just a few weeks later, still recovering from his burns, Ab climbed back in the Meteor III and broke all the 12-hour endurance records. Talk about an ironman!

Long-distance running at high speed is a lonely business. It doesn't have the glamour and the glitz of nose-to-nose competition. Guys who do this sport toil in obscurity.

The Meteor's bare-bones interior doesn't look like a comfy place to spend 24 hours straight at record-setting triple-digit speeds. But that's exactly what Ab Jenkins did—many times. Think today's Corvette ZR1 is impressive? The Meteor's Curtiss Conqueror V12 produced 750 hp.

DURING A COCKPIT FIRE, AB WAS RESCUED BY HIS SON, MARVIN. A FEW WEEKS LATER, HE BROKE THE 12-HOUR ENDURANCE RECORD.

Amazingly, some of Ab's records are still standing. In 1943 he sold the Meteor to the state of Utah for \$1. He could have sold it to make money, but he donated it because he loved his state. Periodically he'd borrow it to set more records. Today it's the star of the forthcoming John Price Museum of Speed in Salt Lake City.

Recently, I had a chance to start up the Meteor. It fires up like an old car—if you were born after 1980 you may not understand. You turn the key of a car today, and there's no sense of warmup or waiting for things to settle in; you just go. But there's a mechanical sensitivity to old cars. You start 'em and, as the cylinders kick in one by one, they go, *PUHPUHPUHPUHooommmmpuhpuhpuh!* You give it a little gas and ease the choke back in to keep it from stalling and maintain that mixture exactly where it should be. There's a great sense of mechanicalness to it.

Although I only drove the Meteor a few hundred yards, it went *GUH-GUHGUHGUH*, and I could feel the tremendous thrust. Engines now are more efficient, and they make more power, but there's nothing like those big displacement engines for torque. You let the gas out, the car leaps forward and you say, "Geez, I didn't do anything." You're moving a lot of metal here. Just to turn this thing, I'd think your arms would ache—but you're mechanically involved.

It's not unlike my watch. At the end of an evening, I like to pick it up and turn the mainspring. It just goes *clickclickclickclick*—it's a very satisfying click. And I feel like I've done something. You either get a kick out of that or you don't. Ab Jenkins would like my watch.

PM

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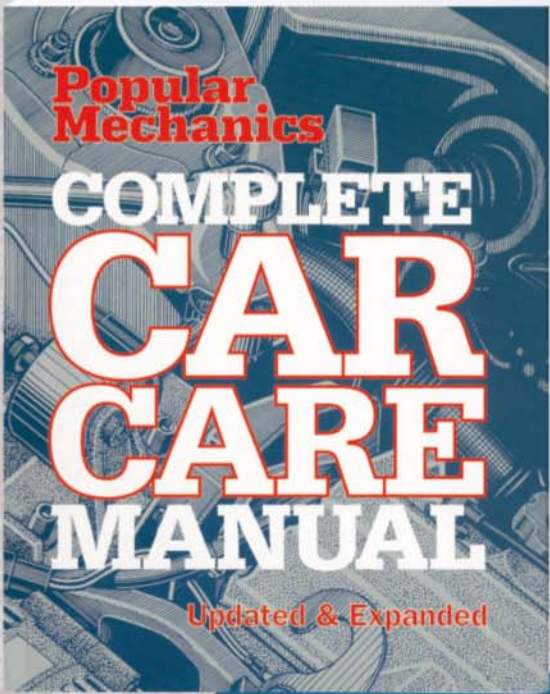
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AMERICA'S TO-DO LIST

> BY JAMES B. MEIGS

> ILLUSTRATION BY IAN KIM



The Obama team enters office with perhaps the thorniest agenda of any administration in memory: managing two wars, rebuilding tattered infrastructure—and coping with a world-class economic crisis.

However, just like a homeowner moving into a new house, the administration needs to do some work immediately, while other jobs can be postponed. And then there are a few tasks so obvious—and affordable—that tackling them immediately is a no-brainer. To help the administration get started, here are five relatively simple policy changes to implement right away.

FAST FIXES FOR U.S. PROBLEMS WITH DIESEL FUEL, FLOOD POLICY, MILITARY PROCUREMENT, THE GRID AND NASA.

plan should equalize those tax rates and stop punishing diesel owners.

★ SUPPORT CLEAN DIESEL

What alternative fuel could cut total consumption by the U.S. passenger vehicle fleet by up to 35 percent and slash CO₂ emissions while requiring no technological breakthroughs and few changes in infrastructure? It's not plug-in hybrids or biofuels. It certainly isn't hydrogen. The answer is regular old diesel. Well, actually, it's the ultra-low-sulfur diesel that has made a fresh generation of clean, ultraefficient engines possible. In a recent PM test, VW's Jetta TDI diesel delivered more than 45 mpg on the highway. That's better than a Prius.

For decades, diesel generally cost a bit less than gasoline. But since 2004, it has been more expensive—at times, a lot more. That's hardly an incentive for people to go out and buy diesel cars. Some of the disparity is due to the cost of converting refineries to make the cleaner fuel. But federal excise taxes also hurt; they run 6 cents per gallon higher for diesel than for gasoline. Any new energy

★ REFORM FLOOD POLICIES

It's a double-barreled problem: Some 37 million Americans have moved to the nation's shorelines since 1980, just as hurricanes have become more destructive. Unfortunately, our current policies make matters worse. The Stafford Act empowers the president to declare an emergency and open a floodgate of money to rebuild the roads, sewers and bridges of storm-damaged

coastal communities. Residents who are frequently hit by hurricanes deserve the nation's sympathy, and perhaps even help in relocating. But there's no reason for taxpayers to keep rebuilding infrastructure—at enormous cost—that only encourages people to remain in harm's way.

An egregious example is Dauphin Island, Ala.—a small island in the Gulf of Mexico jammed with vacation homes—which the United States has repeatedly restored, at a total cost of about \$80 million. (The figure doesn't include outlays to residents from the similarly misguided National Flood Insurance Program.)

"If we weren't rebuilding road access to places like Dauphin Island every few years, the land wouldn't be so desirable," says Robert Young, director of the Program for the Study of Developed Shorelines at Western Carolina University. Given our shared economic distress today, it's simply not fair to make taxpayers foot the bill every time a hurricane wipes out some luxury vacation enclave. By phasing out the program, we could slow the overdevelopment of fragile coastlines and reduce our vulnerability to future disasters.

★ TRIM FUTURE COMBAT SYSTEMS

When it comes to finding places to cut waste, the Pentagon is a target-rich environment. Here's a good place to start: the high-tech, \$160 billion Future Combat Systems program that was a darling of former defense secretary Donald Rumsfeld. FCS incorporates some great technology, like the

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PUBLIC INTEREST ///
AMERICA'S TO-DO LIST

robots and surveillance drones that American forces have embraced in the field. But many FCS items should be cut—in particular, the manned ground vehicles program. Today's Abrams tanks and Strykers are getting the job done, and the FCS's advanced mobile artillery is not our troops' most urgent need. In fact, the program fails a simple standard for judging any weapons system: Does it enhance the intelligence, capability and safety of our forces? These vehicles don't, and they should go.

★ SUPPORT DISTRIBUTED
POWER GENERATION

Who says power has to come from power plants? Almost everyone likes the idea of homes using their own solar panels or wind turbines to generate electricity. And state "net metering" rules encourage homeowners to get involved by crediting their electric bills for the power they supply to the grid. In the long run, net metering can help reduce our reliance on dirty coal-power plants, and make the grid more resistant to blackouts.

But the rules need work. They vary by state, confusing homeowners and discouraging them from investing in equipment. Also, the plans usually compel power companies to buy electricity from homeowners at the full

retail price—so the utilities don't profit when they pass that power on to other consumers. That's okay today, when the amounts of electricity involved are tiny, but it's not sustainable. Imagine a day when much of the power in the grid did come from households. Under current rules, utility revenues would drop just when the system needed expensive upgrades to manage a more complex flow of energy. What incentive would utilities have to improve the grid if the work only served to drive down profits?

In the short term, President Barack Obama can help by proposing a single national standard for net metering. Then, we need to set realistic rates for the electricity that homes and businesses feed back into the grid—a wholesale price, in effect. Electric companies could then evolve into grid *managers*, not only producing power but also adeptly juggling contributions from thousands of clean sources.

★ REBOOT
NASA

With taxpayers struggling, it's going to be hard to justify pouring billions into returning to a lump of rock we've already visited. But right now, NASA's main goal seems to be replaying the greatest hit of the Apollo era, a moon

landing. We can do better. Manned spaceflight is widely supported by the public and is fueled by a basic American optimism and drive toward exploration. But let's make sure we spend our travel budget wisely.

President Obama should convene a task force to hammer out alternative visions for our future in space. Like all big bureaucracies, NASA is

good at protecting its budgets. We need a few outsiders to come in and break some crockery. The panel must include non-NASA experts: space scientists like University of Arizona's

Peter Smith and private-space-flight visionaries like Burt Rutan.

Here are some items for the panel to consider. First, we should keep moving forward on the new Ares launch vehicles. With the space shuttle scheduled for long-overdue retirement in 2010, we need the Ares' heavy-lift capability. Then, let's stop adding to the International Space Station—it was a bad investment and we should move on. Next, outsource cargo-hauling missions in low Earth orbit to private contractors. Finally, leave the moon to China, India and private space ventures. While others literally follow in our footsteps, we should aim higher, building a long-term base on an asteroid—and laying the groundwork for travel to Mars. **PM**

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Clots that block off arteries are the main cause of heart attack. And now that you've had a heart attack you are at a greater risk of having another that can be fatal. That's why your doctor may put you on PLAVIX along with your other heart medicines. Taking PLAVIX with your other heart medicines goes beyond what other heart medicines alone can do to keep blood platelets from sticking together and forming dangerous clots.



IMPORTANT INFORMATION: If you have a stomach ulcer or other condition that causes bleeding, you should not use PLAVIX. When taking PLAVIX alone or with some other medicines including aspirin, the risk of bleeding may increase so tell your doctor before planning surgery. And, always talk to your doctor before taking aspirin or other medicines with PLAVIX, especially if you've had a stroke. If you develop fever, unexplained weakness or confusion, tell your doctor promptly as these may be signs of a rare but potentially life-threatening condition called TTP, which has been reported rarely, sometimes in less than 2 weeks after starting therapy. Other rare but serious side effects may occur.

Ask your doctor how PLAVIX can help increase your protection against future heart attack, stroke, and even death. Or visit www.plavix.com or call 1-800-683-1536.

See important product information on the following page.

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WHO IS PLAVIX FOR?

PLAVIX is a prescription-only medicine that helps keep blood platelets from sticking together and forming clots.

PLAVIX is for patients who have:

- had a recent heart attack.
- had a recent stroke.
- poor circulation in their legs (Peripheral Artery Disease).

PLAVIX in combination with aspirin is for patients hospitalized with:

- heart-related chest pain (unstable angina).
- heart attack.

Doctors may refer to these conditions as ACS (Acute Coronary Syndrome).

Clots can become dangerous when they form inside your arteries. These clots form when blood platelets stick together, forming a blockage within your arteries, restricting blood flow to your heart or brain, causing a heart attack or stroke.

WHO SHOULD NOT TAKE PLAVIX?

You should NOT take PLAVIX if you:

- are allergic to clopidogrel (the active ingredient in PLAVIX).
- have a stomach ulcer
- have another condition that causes bleeding.
- are pregnant or may become pregnant.
- are breast feeding.

WHAT SHOULD I TELL MY DOCTOR BEFORE TAKING PLAVIX?

Before taking PLAVIX, tell your doctor if you're pregnant or are breast feeding or have any of the following:

- gastrointestinal ulcer
- stomach ulcer(s)
- liver problems
- kidney problems
- a history of bleeding conditions

WHAT IMPORTANT INFORMATION SHOULD I KNOW ABOUT PLAVIX?

TTP: A very serious blood condition called TTP (Thrombotic Thrombocytopenic Purpura) has been rarely reported in people taking PLAVIX. TTP is a potentially life-threatening condition that involves low blood platelet and red blood cell levels, and requires urgent referral to a specialist for prompt treatment once a diagnosis is suspected. Warning signs of TTP may include fever, unexplained confusion or weakness (due to a low blood count, what doctors call anemia). To make an accurate diagnosis, your doctor will need to order blood tests. TTP has been reported rarely, sometimes in less than 2 weeks after starting therapy.

Gastrointestinal Bleeding: There is a potential risk of gastrointestinal (stomach and intestine) bleeding when taking PLAVIX. PLAVIX should be used with caution in patients who have lesions that may bleed (such as ulcers), along with patients who take drugs that cause such lesions.

Bleeding: You may bleed more easily and it may take you longer than usual to stop bleeding when you take PLAVIX alone or in combination with aspirin. Report any unusual bleeding to your doctor.

Geriatrics: When taking aspirin with PLAVIX the risk of serious bleeding increases with age in patients 65 and over.

Stroke Patients: If you have had a recent TIA (also known as a mini-stroke) or stroke taking aspirin with PLAVIX has not been shown to be more effective than taking PLAVIX alone, but taking aspirin with PLAVIX has been shown to increase the risk of bleeding compared to taking PLAVIX alone.

Surgery: Inform doctors and dentists well in advance of any surgery that you are taking PLAVIX so they can help you decide whether or not to discontinue your PLAVIX treatment prior to surgery.

WHAT SHOULD I KNOW ABOUT TAKING OTHER MEDICINES WITH PLAVIX?

You should only take aspirin with PLAVIX when directed to do so by your doctor. Certain other medicines should not be taken with PLAVIX. Be sure to tell your doctor about all of your current medications, especially if you are taking the following:

- aspirin
- nonsteroidal anti-inflammatory drugs (NSAIDs)
- warfarin
- heparin

Be sure to tell your doctor if you are taking PLAVIX before starting any new medication.

WHAT ARE THE COMMON SIDE EFFECTS OF PLAVIX?

The most common side effects of PLAVIX include gastrointestinal events (bleeding, abdominal pain, indigestion, diarrhea, and nausea) and rash. This is not a complete list of side effects associated with PLAVIX. Ask your doctor or pharmacist for a complete list.

HOW SHOULD I TAKE PLAVIX?

Only take PLAVIX exactly as prescribed by your doctor. Do not change your dose or stop taking PLAVIX without talking to your doctor first.

PLAVIX should be taken around the same time every day, and it can be taken with or without food. If you miss a day, do not double up on your medication. Just continue your usual dose. If you have any questions about taking your medications, please consult your doctor.

OVERDOSAGE

As with any prescription medicine, it is possible to overdose on PLAVIX. If you think you may have overdosed, immediately call your doctor or Poison Control Center, or go to the nearest emergency room.

FOR MORE INFORMATION

For more information on PLAVIX, call 1-800-633-1610 or visit www.PLAVIX.com. Neither of these resources, nor the information contained here, can take the place of talking to your doctor. Only your doctor knows the specifics of your condition and how PLAVIX fits into your overall therapy. It is therefore important to maintain an ongoing dialogue with your doctor concerning your condition and your treatment.

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PLA-OCT07-B-Aa

The Human Machine

By Melinda Wenner

Diagrams by Sinelab

20 BREAKTHROUGHS
THAT BLUR THE LINE
BETWEEN BIOLOGY AND
TECHNOLOGY—TO HELP
RESTORE, IMPROVE AND
EXTEND OUR LIVES.

● 4 Cancer Spit Test

Forget biopsies—a device designed by researchers at the University of California—Los Angeles detects oral cancer from a single drop of saliva. Proteins that are associated with cancer cells react with dyes on the sensor, emitting fluorescent light that can be detected with a microscope. Engineer Chih-Ming Ho notes that the same principle could be applied to make saliva-based diagnostic tests for many diseases.

● 1 Decay- Fighting Microbes

Bacteria living on teeth convert sugar into lactic acid, which erodes enamel and causes tooth decay. Florida-based company ONI BioPharma has engineered a new bacterial strain, called SMaRT, that cannot produce lactic acid—plus, it releases an antibiotic that kills the natural decay-causing strain. Dentists will only need to swab SMaRT, now in clinical trials, onto teeth once to keep them healthy for a lifetime.

● 2 Artificial Lymph Nodes

Scientists from Japan's RIKEN Institute have developed artificial versions of lymph nodes, organs that produce immune cells for fighting infections. Though they could one day replace diseased nodes, the artificial ones may initially be used as customized immune boosters. Doctors could fill the nodes with cells specifically geared to treat certain conditions, such as cancer or HIV.



● 5 Biological Pacemaker

Electronic pacemakers save lives, but use hardware that eventually wears out. Now, researchers at several universities are developing a batteryless alternative: pacemaker genes expressed in stem cells that are injected into damaged regions of the heart. Better suited for physical exertion, biological pacemakers have been shown to bring slow canine hearts back up to speed without complications.

3 ● Asthma Sensor

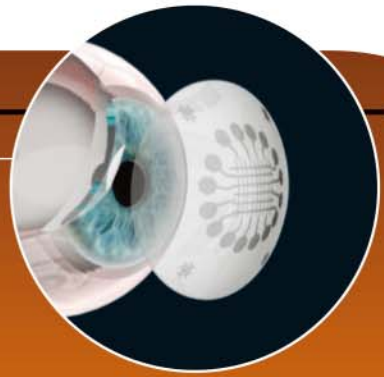
Asthma accounts for a quarter of all emergency room visits in the U.S., but a sensor developed at the University of Pittsburgh may finally cause that number to plummet. Inside the handheld device, a polymer-coated carbon nanotube—100,000 times thinner than a human hair—analyzes breath for minute amounts of nitric oxide, a gas that lungs produce prior to asthma attacks.

6 Prosthetic Feedback

One challenge of prosthetic limbs is that they're difficult to monitor. "You and I sense where our limbs are spatially without having to look at them, whereas amputees don't," says Stanford University graduate student Karlin Bark. Skin is sensitive to being stretched—it can detect even small changes in direction and intensity—so Bark is developing a device that stretches an amputee's skin near the prosthesis in ways that provide feedback about the limb's position and movement.

7 Smart Contact Lens

Glaucoma, the second-leading cause of blindness, develops when pressure builds inside the eye and damages retinal cells. Contact lenses developed at the University of California–Davis contain conductive wires that continuously monitor pressure and fluid flow within the eyes of at-risk people. The lenses then relay information to a small device worn by the patient; the device wirelessly transmits it to a computer. This constant data flow will help doctors better understand the causes of the disease. Future lenses may also automatically dispense drugs in response to pressure changes.



8 Speech Restorer

For people who have lost the ability to talk, a new "phonetic speech engine" from Illinois-based Ambient Corporation provides an audible voice. Developed in conjunction with Texas Instruments, the Audeo uses electrodes to detect neuronal signals traveling from the brain to the vocal cords. Patients imagine slowly sounding out words; then the quarter-size device (located in a neck brace) wirelessly transmits those impulses to a computer or cellphone, which produces speech.

9 Absorbable Heart Stent

Stents open arteries that have become narrowed or blocked because of coronary artery disease. Drug-eluting stents release medication that keeps the artery from narrowing again. The bio-absorbable version made by Abbott Laboratories in Illinois goes one step further: Unlike metal stents, it does its job and disappears. After six months the stent begins to dissolve, and after two years it's completely gone, leaving behind a healthy artery.



10 Muscle Stimulator

In the time it takes for broken bones to heal, nearby muscles often atrophy from lack of use. Israeli company StimuHeal solves that problem with the MyoSpare, a battery-operated device that uses electrical stimulators—small enough to be worn underneath casts—to exercise muscles and keep them strong during recovery.

11 Nerve Regenerator

Nerve fibers can't grow along injured spinal cords because scar tissue gets in the way. A nanogel developed at Northwestern University eliminates that impediment. Injected as a liquid, the nanogel self-assembles into a scaffold of nanofibers. Peptides expressed in the fibers instruct stem cells that would normally form scar tissue to produce cells that encourage nerve development. The scaffold, meanwhile, supports the growth of new axons up and down the spinal cord.

12 Stabilizing Insoles

When Erez Lieberman's grandmother suffered a dangerous fall, he wanted to ensure it never happened again. "But it wasn't till a few years later at NASA that I found a way to channel that into something tangible," says the MIT graduate student. Using technology developed to monitor the balance of astronauts who have just returned from space, Lieberman's iShoe analyzes the pressure distribution of the feet. Doctors can use the insole to diagnose balance problems in elderly patients before falls occur.

13 Smart Pill



California-based Proteus Biomedical has engineered sensors that track medication use by recording the exact time drugs are ingested. Sand-grain-size microchips emit high-frequency electrical currents that are logged by Band-Aid-like receivers on the skin. The receivers also monitor heart rate and respiration and wirelessly transmit the data to a computer. "To really improve pharmaceuticals, we need to do what is now common in every other industry—embed digital technology into existing products and network them," says David O'Reilly, senior vice president of corporate development.

14 Autonomous Wheelchair

MIT researchers have developed an autonomous wheelchair that can take people where they ask to go. The chair learns about its environment by

listening as a patient identifies locations—such as “this is my room” or “we’re in the kitchen”—and builds maps using Wi-Fi, which works well indoors (unlike

GPS). The current model, which is now being tested, may one day be equipped with cameras, laser rangefinders and a collision-avoidance system.



15 Gastrointestinal Liner

Obesity is associated with type II diabetes, which over time wears out the pancreas. A gastrointestinal liner developed by Massachusetts-based GI Dynamics may restore the obese to a healthy weight by preventing food from contacting the intestinal wall. The Endobarrier is routed endoscopically through the mouth—unlike a gastric bypass, no surgery is necessary—and lines the first 2 ft of the small intestine, where the most calories are absorbed (nutrients are still absorbed farther down the intestine).

16 Liver Scanner

How healthy is your liver? Until recently, answering that question often required a painful biopsy. French company EchoSens has developed a machine that scans the organ for damage in just 5 minutes. Studies have shown that damaged livers become stiffer and less elastic, so the scanner, called the Fibroscan, measures the organ's elasticity using ultrasound.



18 Portable Dialysis

More than 15 million adult Americans suffer from diseases of the kidneys, which often impair the ability of the organs to remove toxins from the blood. Standard dialysis involves three long sessions at a hospital per week. But an artificial kidney developed by Los Angeles-based Xcorporeal can clean blood around the clock. The machine is fully automated, battery-operated, waterproof and, at less than 5 pounds, portable.

17 Nanoscale Adhesive

Gecko feet are covered with nano-size hairs that exploit intermolecular forces, allowing the lizards to stick firmly to surfaces. By replicating this nanoscale topography, MIT scientists have developed an adhesive that can seal wounds or patch a hole caused by a stomach ulcer. The adhesive is elastic, waterproof and made of material that breaks down as the injury heals.

19 Walking Simulator

Stroke victims are being tricked into recovering more quickly with a virtual-reality rehabilitation program developed at the University of Portsmouth in Britain. As patients walk on a treadmill, they see moving images that fool their brains into thinking they are walking slower than they are. As a result, patients not only walk faster and farther, but experience less pain while doing so.

20 Rocket-Powered Arm



Adding strength to prosthetic limbs has typically required bulky battery packs. Vanderbilt University scientist Michael Goldfarb came up with an alternative power source: rocket propellant. Goldfarb's prosthetic arm can lift 20 pounds—three to four times more than current prosthetics—thanks to a pencil-size version of the mono-propellant rocket-motor system used to maneuver the space shuttle in orbit. Hydrogen peroxide powers the arm for 18 hours of normal activity.



**“I’m taking an antidepressant,
but I think I might need more help.”**

Approximately 2 out of 3 people being treated for depression still have depression symptoms. If an antidepressant alone isn’t enough, talk to your doctor. Your options may include **adding ABILIFY to the antidepressant you’re already taking.**

ABILIFY is the only medicine FDA-approved to treat depression in adults when added to an antidepressant (such as Lexapro®, Zoloft®, Prozac®, Effexor XR® or Paxil CR®).*

IMPORTANT SAFETY INFORMATION:

Elderly patients with dementia-related psychosis (eg, an inability to perform daily activities due to increased memory loss) taking ABILIFY have an increased risk of death or stroke. ABILIFY is not approved for treating these patients.

Antidepressants can increase suicidal thoughts and behaviors in children, teens, and young adults. Serious mental illnesses are themselves associated with an increase in the risk of suicide. When taking ABILIFY call your doctor right away if you have new or worsening depression symptoms, unusual changes in behavior, or thoughts of suicide. Patients and their caregivers should be especially observant within the first few months of treatment or after a change in dose. Approved only for adults 18 and over with depression.

- Alert your doctor if you develop very high fever, rigid muscles, shaking, confusion, sweating, or increased heart rate and blood pressure, as these may be signs of a rare but potentially fatal condition called neuroleptic malignant syndrome (NMS)
- If you develop abnormal or uncontrollable facial movements, notify your doctor, as these may be signs of tardive dyskinesia (TD), which could become permanent
- If you have diabetes or have risk factors or symptoms of diabetes, your blood sugar should be monitored. High blood sugar has been reported with ABILIFY and medicines like it. In some cases, extreme high blood sugar can lead to coma or death
- Other risks may include lightheadedness upon standing, seizures, trouble swallowing, or impairment in judgment or motor skills. Until you know how ABILIFY affects you, you should not drive or operate machinery

The common side effects in adults in clinical trials ($\geq 10\%$) include nausea, vomiting, constipation, headache, dizziness, an inner sense of restlessness or need to move (akathisia), anxiety, and insomnia. Tell your doctor about all the medicines you’re taking, since there are some risks for drug interactions. You should avoid alcohol while taking ABILIFY.

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.fda.gov/medwatch, or call 1-800-FDA-1088.

Please read the Important Information about ABILIFY on the adjacent page.

* Lexapro® (escitalopram oxalate), Zoloft® (sertraline HCl), Prozac® (fluoxetine hydrochloride), Effexor XR® (venlafaxine HCl), Paxil CR® (paroxetine HCl) are trademarks of their respective companies.

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IMPORTANT INFORMATION ABOUT ABILIFY

This summary of the Package Insert contains risk and safety information for patients about ABILIFY. This summary does not include all information about ABILIFY and does not take the place of discussions with your healthcare professional about your treatment. Please read this important information before you start taking ABILIFY and discuss any questions about ABILIFY with your healthcare professional.

Name

ABILIFY® (a-BIL-ĭ-fĭ) (aripiprazole) (air-ĭ-PIP-ra-zoll)

What is ABILIFY?

ABILIFY (aripiprazole) is a prescription medicine used as an add-on treatment to antidepressants for Major Depressive Disorder in adults.

What is depression?

Depression is a common but serious medical condition. Symptoms may include sadness, loss of interest in activities you once enjoyed, loss of energy, difficulty concentrating or making decisions, feelings of worthlessness or excessive guilt, insomnia or excessive sleep, a change in appetite causing weight loss or gain, or thoughts of death or suicide. These could be depression symptoms if they interfere with daily life at home, at work, or with friends and last most of the day, nearly every day for at least 2 weeks.

What is the most important information that I should know about antidepressant medicines, depression, and other serious mental illnesses?

- Antidepressant medicines may increase suicidal thoughts or actions in some children, teenagers, and young adults
- Depression and serious mental illnesses are the most important causes of suicidal thoughts and actions

For more information, see the Prescribing Information and the Medication Guide called *Antidepressant Medicines, Depression and Other Serious Mental Illnesses, and Suicidal Thoughts or Actions*.

Who should NOT take ABILIFY?

People who are allergic to ABILIFY or to any substance that is in it. Allergic reactions have ranged from rash, hives and itching to difficulty breathing and swelling of the face, lips, or tongue. Please talk with your healthcare professional.

What is the most important information that I should know about ABILIFY?

Elderly patients, diagnosed with psychosis as a result of dementia (for example, an inability to perform daily activities as a result of increased memory loss), and who are treated with antipsychotic medicines including ABILIFY, are at an increased risk of death when compared to patients who are treated with a placebo (sugar pill). ABILIFY is not approved for the treatment of patients with dementia-related psychosis.

Antidepressants may increase suicidal thoughts or behaviors in some children, teenagers, and young adults, especially within the first few months of treatment or when the dose is changed. Depression and other serious mental illnesses are themselves associated with an increase in the risk of suicide. Patients on antidepressants and their families or caregivers should watch for new or worsening depression symptoms, unusual changes in behavior, or thoughts of suicide. Such symptoms should be reported to the patient's healthcare professional right away, especially if they are severe or occur suddenly. ABILIFY is not approved for use in pediatric patients with depression.

Serious side effects can occur with any antipsychotic medicine, including ABILIFY. Tell your healthcare professional right away if you have any conditions or side effects, including the following:

Stroke or ministroke in elderly patients with dementia: An increased risk of stroke and ministroke has been reported in clinical studies of elderly patients with dementia (for example, increased memory loss and inability to perform daily activities). ABILIFY is not approved for treating patients with dementia.

Neuroleptic malignant syndrome (NMS): Very high fever, rigid muscles, shaking, confusion, sweating, or increased heart rate and blood pressure may be signs of NMS, a rare but serious side effect that could be fatal.

Tardive dyskinesia (TD): Abnormal or uncontrollable movements of face, tongue, or other parts of body may be signs of a serious condition known as TD, which may be permanent.

High blood sugar and diabetes: Patients with diabetes and those having risk factors for diabetes (for example, obesity, family history of diabetes), as well as those with symptoms such as unexpected increases in thirst, urination, or hunger should have their blood sugar levels checked before and during treatment. Increases in blood sugar levels (hyperglycemia), in some cases serious and associated with coma or death, have been reported in patients taking ABILIFY, and medicines like it.

Orthostatic hypotension: Lightheadedness or faintness caused by a sudden change in heart rate and blood pressure when rising too quickly from a sitting or lying position (orthostatic hypotension) has been reported with ABILIFY.

Suicidal thoughts: If you have suicidal thoughts, you should tell your healthcare professional right away.

Dysphagia: Medicines like ABILIFY (aripiprazole) have been associated with swallowing problems (dysphagia). If you had or have swallowing problems, you should tell your healthcare professional.

What should I talk to my healthcare provider about?

Patients and their families or caregivers should watch for new or worsening depression symptoms, unusual changes in behavior and thoughts of suicide, as well as for anxiety, agitation, panic attacks, difficulty sleeping, irritability, hostility, aggressiveness, impulsivity, restlessness, or extreme hyperactivity. Call your healthcare provider right away if you have thoughts of suicide or if any of these symptoms are severe or occur suddenly. Be especially observant within the first few months of antidepressant treatment or whenever there is a change in dose.

Tell your healthcare provider about any medical conditions you may have and all medicines that you are taking or plan to take, including prescription and nonprescription (over-the-counter) medicines.

Be sure to tell your healthcare provider:

- If you have suicidal thoughts
- If you or anyone in your family have or had seizures
- If you or anyone in your family have or had high blood sugar or diabetes
- If you are pregnant, plan to become pregnant, or are breast-feeding

What should I avoid when taking ABILIFY?

- Avoid overheating and dehydration
- Avoid driving or operating hazardous machinery until you know how ABILIFY affects you
- Avoid drinking alcohol
- Avoid breast-feeding an infant

What are the possible side effects of ABILIFY?

Common side effects in adults include: nausea, vomiting, constipation, headache, dizziness, an inner sense of restlessness or need to move (akathisia), anxiety and insomnia.

It is important to contact your healthcare professional if you experience prolonged, abnormal muscle spasm or contraction which may be signs of a condition called dystonia.

What percentage of people stopped taking ABILIFY due to side effects?

In clinical trials, the percentage of adults who discontinued taking ABILIFY due to side effects was ABILIFY (6%) and for patients treated with sugar pill (2%).

Can I safely take ABILIFY while I'm taking other medications?

ABILIFY can be taken with most drugs; however, taking ABILIFY with some medicines may require your healthcare professional to adjust the dosage of ABILIFY.

Some medicines* include:

- ketoconazole (NIZORAL®)
- quinidine (QUINIDEX®)
- fluoxetine (PROZAC®)
- paroxetine (PAXIL®)
- carbamazepine (TEGRETOL®)

It is important to tell your healthcare professional about all the medicines you're taking, just to be sure.

General advice about ABILIFY:

- ABILIFY is usually taken once a day, with or without food
- ABILIFY should be kept out of the reach of children and pets
- Store ABILIFY Tablets and the Oral Solution at room temperature
- For patients who must limit their sugar intake, be aware that ABILIFY Oral Solution contains sugar
- For patients who cannot metabolize phenylalanine (those with phenylketonuria or PKU), ABILIFY DISCMLT® contains phenylalanine
- If you have additional questions, talk to your healthcare professional

Find out more about ABILIFY:

Additional information can be found at www.abilify.com

* NIZORAL is a registered trademark of Janssen Pharmaceutica; QUINIDEX is a registered trademark of Wyeth Pharmaceuticals; PROZAC is a registered trademark of Eli Lilly and Company; PAXIL is a registered trademark of GlaxoSmithKline; TEGRETOL is a registered trademark of Novartis Pharmaceuticals.

Based on Full Prescribing Information as of 05/08 1239550A2.

 **Bristol-Myers Squibb**  **Otsuka** Otsuka America Pharmaceutical, Inc.

Tablets manufactured by Otsuka Pharmaceutical Co., Ltd., Tokyo, 101-8535 Japan or Bristol-Myers Squibb Company, Princeton, NJ 08543 USA.
Orally Disintegrating Tablets, Oral Solution, and Injection manufactured by Bristol-Myers Squibb Company, Princeton, NJ 08543 USA.
Distributed and marketed by Otsuka America Pharmaceutical, Inc., Rockville, MD 20850 USA.
Marketed by Bristol-Myers Squibb Company, Princeton, NJ 08543 USA.
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Stephenville residents re-enact responses to bizarre lights seen above their central-Texas town in January 2008 and again in October and November.

SOMETHING IN THE SKY

WHAT WERE THE SPEED-SHIFTING, COLOR-MORPHING UFOS THAT MYSTIFIED HUNDREDS OF EYEWITNESSES AROUND STEPHENVILLE, TEXAS, LAST JANUARY? OPTICAL ILLUSIONS? SECRET MILITARY OPERATIONS? ALIEN SPACESHIPS? PM INVESTIGATES.

AUTHOR:

PHIL PATTON

ADDITIONAL REPORTING:

DAVIN COBURN, ERIN MCCARTHY, JOE PAPPALARDO AND ERIK SOFGE

"IT WAS THE MOST BEAUTIFUL SUNSET I'D EVER SEEN," SAYS STEVE ALLEN, who has seen 50 years of sunsets in central Texas. "That's what I first thought."

It was Jan. 8, 2008, and the trucking entrepreneur was sitting around a fire outside the Selden, Texas, home of Mike Odom, his friend since first grade. Then he saw the lights—orbs that glowed at first, then began to flash. "There was no regular pattern to the flashing," he says. "They lined up horizontally, seven of them, then changed into an arch. They lined up vertically, and I saw two rectangles of bright flame. That's when I knew it was a life-changing experience." He watched the lights

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PHOTOGRAPHS:

STEPHANIE DE ROUGE

DIAGRAMS:

DOGO

drift north toward Stephenville, the seat of Erath County. "They came back a few minutes later," Allen says, "this time followed by two jets—F-16s, I think." Allen, who owns and flies a Cessna, has seen plenty of military planes over the years. "The jets looked like they were chasing the lights, and the lights seemed to be toying with them. It was like a 100-hp car trying to keep up with a 1000-hp one."

Odom also saw the lights and called to his wife, Claudette, who came outside in time to see the second display. When Allen returned home, he phoned friends at the local airport who checked with the Fort Worth airport tower. "Both said nothing was flying," Allen says.

That night, James Huse, a former Air Force navigation specialist, was in downtown Stephenville saying good-night to a couple of friends. "Out of the corner of my eye I saw two red orbs moving overhead," he says, "the reddest things I'd ever seen in the sky. They came right in front of me at 2000 ft about half a mile away. They weren't going that fast, maybe 60 mph. They didn't make any noise."

Outside Dublin, about 15 miles southwest of Stephenville, Constable Lee Roy Gaitan finished eating a slice of his wife's birthday cake, then headed out to his patrol car to get his wallet so his family could watch *Mr. Bean* on pay per view. That's when he saw the lights. "First, I saw a yellow-red orb the color of lava in a volcano," he says. "Then, instead of the red orbs, there were nine or 10 flashing lights maybe 3000 ft in the air, bouncing and very bright. They hovered there, strobing for 2 or 3 minutes, bright like German auto headlights. Then they shot off at blazing speed like a school of fish, you know, when it's frightened." Later, Gaitan says, two jets flew over.

The next day Allen called Angelia Joiner, a reporter at the *Stephenville Empire-Tribune*, and told his story. The

THE EYEWITNESSES



STEVE ALLEN
*Trucking Company
Owner*

"The flashing lights lined up horizontally, seven of them, then changed into an arch. They lined up vertically, and I saw two rectangles of bright flame. It was a life-changing experience."



LEE ROY GAITAN
Constable (left)

"First, I saw a yellow-red orb the color of lava in a volcano. Then there were nine or 10 flashing lights at maybe 3000 ft in the air, bouncing and very bright."

●
JAMES HUSE
Retired (far right)

"I saw two red orbs moving overhead—the reddest things I'd ever seen in the sky. They came right in front of me at 2000 ft about half a mile away. They weren't going that fast; maybe 60 mph. They didn't make any noise."

●
MAC MCKINNON
Publisher/Editor (right)

"I saw a very bright light in the sky that was very high. It never moved. It wasn't a star, wasn't a plane. I believe that all people are seeing is some kind of military experiment."

paper published Joiner's piece—"Possible UFO Sighting"—on Jan. 10. It was the first of her numerous articles about the lights. On Jan. 11, Joiner called Maj. Karl Lewis, public affairs officer of the 301st Fighter Wing at the Naval Air Station Joint Reserve Base Fort Worth (formerly Carswell Air Force Base and now used by all the services). Lewis said the base had nothing flying the night of the sightings. Other nearby bases issued similar denials.

It all added up to the most dramatic UFO incident in more than a decade. "Texas Town Abuzz Over Dozens of UFO

Sightings," wrote Foxnews.com. "Are UFOs Invading Texas?" asked *Texas Monthly*. "UFOs Put Stephenville in World Spotlight," said the *Fort Worth Star-Telegram*. CNN showed up, along with ABC, the BBC and other TV crews from as far away as Japan. So did Bill O'Reilly and Larry King. A longtime UFO fan, King devoted a segment to Stephenville and interviewed Gaitan and Joiner. Jake and Dorothy's Café, near the courthouse square, became a favored journalist hangout. "One day I went into Jake and Dorothy's for coffee, the way I always do," Huse says, "and there was a

TV crew on one side of me and reporters on the other."

The Stephenville sightings had all the elements of a classic UFO incident—first reports, official denials, independent witnesses stepping forward. The Texas dairy town of 17,000 with the statue of a cow in the main square had joined Roswell, Area 51 and other small places as an iconic name in the annals of UFOs.

ON THE DECEMBER NIGHT I DRIVE from Dallas to Stephenville, the moon is in congruence with Venus and Jupiter:

The two planets and crescent suggest a flag's heraldic pattern. By the end of the evening, the sinking moon is huge and orange, like a Ferris-wheel-size slice of cantaloupe hung in the trees.

The illusion that the moon is bigger near the horizon is just one of the tricks our eyes play on us when we observe objects in the heavens. Humanity has long infused these mysterious shapes and lights with portents and meanings interpreted according to the cultural notions of the day. The star-related deities of the Egyptians, the godlike comets of the Greeks, the mysterious shapes in the skies of Renaissance frescoes—all were forerunners of flying saucers. “The tendency to believe in the paranormal appears to be there from the beginning,” Christopher Bader, a Baylor University sociologist, told LiveScience. “What changes is the content. Few people believe in fairies and elves these days. But as belief in fairies faded, other beliefs, such as belief in UFOs, emerged to take its place.”

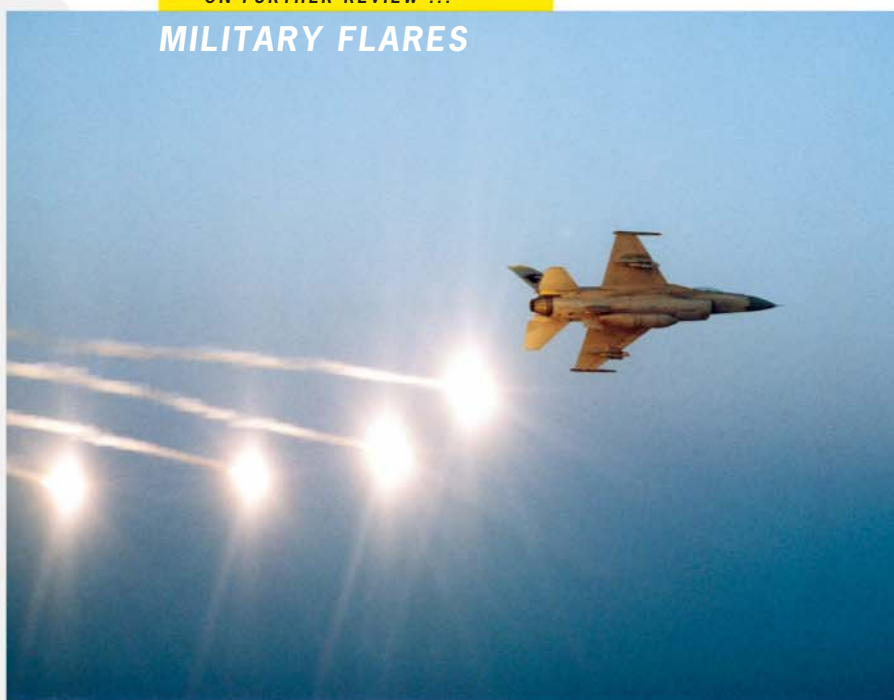
There is no dispute that UFOs exist—that is, objects flying through the sky that are unidentified. (In fact, one in seven Americans say they have seen UFOs.) But that, of course, does not mean they are ships from a distant galaxy. We humans tend to leap to conclusions, imagining alien spacecraft while discounting more likely explanations.

Over the centuries, the technology to record UFOs has evolved from marks on clay to video clips, and the causes of sightings may have changed from comets to secret aircraft, but the psychological pattern endures: It is the story of people projecting hopes and fears onto objects in the sky.

THE MUTUAL UFO NETWORK (MUFON), which is probably the most influential organization within the highly combative and suspicious UFO community, received so many reports about the

ON FURTHER REVIEW ...

MILITARY FLARES



An F-16 banks after ejecting a string of flares designed to fool antiaircraft missiles. The military does not discuss details of flares for fear of betraying decoy strategies.



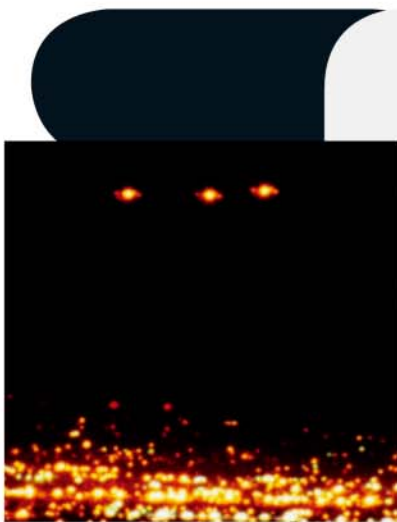
It was the biggest UFO sighting in years, witnessed by thousands of Phoenix residents—a string of bright lights that appeared around 10 pm on Mar. 13, 1997, before disappearing over the Estrella mountain range. The Air Force initially

claimed that no warplanes were in the area. Two months later, officials from Davis-Monthan Air Force Base near Tucson cited a logbook error and confirmed that Maryland Air National Guard A-10 pilots completing a training exercise ejected leftover illumination flares near Phoenix before returning to base. “One of our guys had about 10 or so left,” Lt. Col. Ed Jones

told the *Arizona Republic*, “so he started to puke them out, one after another.” Illumination flares on parachutes form long-lasting shapes in the sky, but other airplane flares act much differently. Decoy flares spoof the sensors of antiaircraft missiles. Infrared decoys form heat signatures that resemble those of airplanes. Since some missiles discriminate targets by their movement,

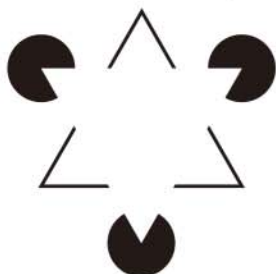
Seeing, Not Believing

Why are people who see isolated lights so sure they are observing a solid UFO? The same reason the ancients saw figures in the stars: A need to make sense of what's around us, says Stanford ophthalmology professor Michael Marmor. “If you see lights that seem to form a circle, you try to fill it in,” he says. Viewing the illusion developed by psychologist Gaetano Kanizsa in 1955 (opposite), observers think they see an intact triangle brighter than the surrounding space.



The 1997 Phoenix lights were actually parachute-equipped illumination flares.

kinematic decoys are designed to fly as fast as the warplane that ejects them, at least briefly. "Some even come with thrusters," says Dennis Clark, a countermeasures engineer at BAE Systems. These flares extinguish quickly, which from the ground could appear to be unearthly acceleration. New missiles have sensors that use color to distinguish target airplanes, so a new type of multispectral flare changes hues to defeat them.



Stephenville lights that the Colorado-based group set up an open hearing in nearby Dublin, Texas, birthplace of Dr Pepper and golfer Ben Hogan. On Sat., Jan. 19, some 500 people streamed into the 1909 brick building that is home to the local Rotary Club. "Everywhere I turned there were TV tripods," says Steve Hudgeons, a Fort Worth construction project manager and chief of MUFON's investigations in Texas.

Many people in attendance were simply curious. A few wore tinfoil caps. But more than 200 people came forward to tell their stories, with some sightings going back 30 years. Hudgeons and other MUFON investigators considered about 20 reports to be substantive and relevant to the Jan. 8 incident and promised to publish a report.

On Jan. 23, 12 days after denying it had planes in the air, the military reversed itself. According to a carefully worded press release issued by Air Force Reserve Command Public Affairs, "Ten F-16s from the 457th Fighter Squadron were performing training operations from 6 to 8 pm on Jan. 8 in the Brownwood Military Operations Area [MOA], which includes the airspace above Erath County."

Why the flip-flop? "It was an internal communications problem that has now been fixed," says 301st Fighter Wing spokesman Lewis. Inconsistent disclosures by the military have often fueled UFO speculation. The military changed its story about Roswell numerous times after 1947, when Air Force officials first claimed to have "captured" a flying saucer, then denied it.

Adding to the atmosphere of mistrust is the military's refusal to release details of operations, including training flights. Lewis declines to give specifics on hardware or tactics used over Erath County. During training, he says, "we fly like we fight."

By mid-February the *Empire-Tribune* had lost interest in the Stephenville

lights; their reporter Joiner had not. She left the paper to run a Web site about the sightings, funded by Allen. The *Dublin Citizen*, however, continued to pursue the story. Publisher and editor Mac McKinnon, a former Air Force historian whose office is hung with model warplanes from his days in the service, saw some curious lights in January. "I believe the military has all sorts of exotic propulsion systems and other technologies we don't even know about," he says. He assigned the story to reporter Jon Awbrey, who also saw lights—"a triangle with squares at the corners."

Awbrey put me in touch with Dublin police chief Lannie Lee. In January two of his men had taped one of the lights using the dashboard video in their patrol car. He had not made the tape public. "I didn't want any notoriety to be attached to the department," the mild-mannered chief says.

He pulls out a VHS tape and leads me to the back of the station and puts it in the machine. On the screen, a dot appears against a black sky and begins to dance. The camera zooms in on a shimmering, bouncing but otherwise featureless circle of light. "It goes on like that for about an hour," Lee says.

The reports from January reminded another Dublin resident, machinist Ricky Sorrells, of a huge object he says he saw in December when he was deer hunting. "I looked at it through the scope on my deer rifle," Sorrells tells me over burgers at the Dublin Dairy Queen. He is a big man who has just come in from hunting, dressed in full camouflage. He describes what he saw as a "huge gray object," the color of galvanized metal, with no rivets, bolts or seams. "It was about 100 ft tall and about 300 ft up in the air," he says, comparing the height of the object to the grain elevator where he once worked.

It was the first of several sightings for Sorrells. He captured one of them on video. In the Dairy Queen, he unfolded

ON FURTHER REVIEW ...

CULTURAL
INFLUENCES

On June 24, 1947, pilot Kenneth Arnold claimed he saw gleaming aircraft he

later described as "saucerlike objects." He had no photos to bolster the first and most famous report of a flying saucer. In *Fate* magazine, Arnold wrote: "I would have given almost anything that day to have had a movie camera." His vision of

saucer-shaped craft was quickly embraced by popular culture, showing up in comics, movies, even children's toys. Astronomer Carl Sagan noted that depictions of UFOs in entertainment often have a strong influence on how

observers perceive phenomena in the sky. Sure enough, over the next few years UFO sightings increasingly mentioned silvery, saucer-shaped objects. Such UFO iconography is reinforced by a cultural feedback loop: a report offers

1948



In this alien-centric magazine's first issue, Kenneth Arnold recounts his then-famous UFO sighting over Washington state.

1950



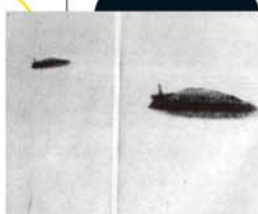
Marine Corps officer and aviation enthusiast Donald Keyhoe's first book contends that the Air Force is covering up evidence of UFOs.

1956



While it may not have lived up to its headline as "the greatest shock film of all time," this sci-fi B-movie classic features Ray Harryhausen's special-effects magic as animated flying saucers with now-standard shapes obliterate practically every international landmark.

1967



Teenage brothers Dan and Grant Jaroslaw claim to snap sensational Polaroids of a UFO over Lake St. Clair, near Detroit. The images make front-page news and survive initial expert scrutiny, but the boys later admit it's a hoax.

1975



Nearly two years before *Star Wars*, James Earl Jones stars in this re-enactment of Betty and Barney Hill's alleged alien abduction outside Groveton, N.H., in 1961.

his cellphone and handed it to me. I saw a tiny video of a barely discernable white shape moving through the sky.

AFTER ITS DUBLIN OPEN HEARING, MUFON filed Freedom of Information Act requests with the military branches and other governmental agencies. Only the Federal Aviation Administration and the National Weather Service acknowledged they had relevant information and forwarded radar data.

In July, the group released its report, which suggests that several fighters as

well as an Airborne Warning and Control System (AWACS) plane were in the area. But so, they claim, was a mysterious large object, without the required transponder that identifies and locates aircraft. The report concludes that a very large unidentified craft or object "was tracked on radar for over an hour. Most of the time, the object was either stationary or moving at speeds of less than 60 mph. At 7:32 pm, the object was tracked accelerating to 532 mph in 30 seconds and then slowing to 49 mph only 10 seconds later."

Radar blips would seem to present a

positive, nonsubjective way to observe UFOs. Studies from the Condon Report, published in 1968 by the University of Colorado, to the Air Force's Blue Book project to a 1997 evaluation by the Society for Scientific Exploration, however, have found that radar can be "fooled" in simple ways. Anomalous propagation, or false echoes, is most often caused by ground clutter, often a result of low-level temperature inversions that muffle ground radar's electronic pulse and lead to a circular scatter of returns based on hits from buildings and trees.

In extreme examples, called ducting,

intriguing new details; the entertainment industry amplifies those images; and future sightings “confirm” their existence. Hoaxes—pie-plate photos, crop circles, *Alien Autopsy: (Fact or Fiction?)* on the Fox network—abet the

process, no matter how conclusively debunked. Just as the ancients were inclined to see gods and flaming chariots in the skies, modern humans became primed to see saucers and aliens whenever something strange appeared overhead.

UFO sightings evolve with the culture. By the ‘60s, classic saucer images had started to fade. Instead, people began reporting more direct contact with aliens (who often resembled the big-eyed creatures seen in the TV movie

The UFO Incident). But a darker strain emerged, when tales of gray aliens performing experiments on human abductees flourished. UFO stories sometimes took on spiritual dimensions: Aliens were godlike creatures coming to

save our planet—or transport us to a better one.

In recent years, most UFO reports have grown far less sensational; many sightings these days simply describe lights in the sky.

Arnold regretted not having a camera at hand during his

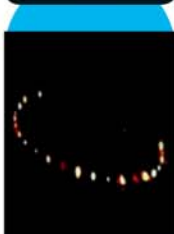
sighting. Today camera phones and video cameras are ubiquitous. And yet clear, detailed images have all but disappeared from the photographic record. Even the clearest recent images are little more than glowing dots and squiggles.

1977



UFOs evolve from sleek saucers to clusters of lights in Steven Spielberg's *Close Encounters of the Third Kind*. The film brings religious overtones to the topic, implying that belief in aliens is a matter of faith, not science. *E.T.: The Extra-Terrestrial* (1982) echoes that theme. Together, the films gross over \$1 billion.

1983



More than 300 people in the Hudson Valley report seeing V- and boomerang-shaped lights in March 1983. It's a hoax by pilots flying out of Stormville, N.Y., who rig their planes with extra lights before formation flights.

1987



Horror novelist Whitley Strieber describes his abduction by “the visitors.” A 1989 movie based on the book stars Christopher Walken; in 1999, the National UFO Conference names Strieber “UFOlogist of the Year.”

1987



Ed Walters takes photos of a purported spacecraft over the Florida panhandle—but accidentally leaves the model (made of Styrofoam plates and bowls) in his house when he moves, and new owners find it.

2008



On March 14, 2008, residents of Wesley Chapel, Fla., are spooked by a hovering, rotating triangle of blue lights and a blinking red light. The sheriff's office confirms it's a hoax—a homemade balloon with lights.

the temperature inversion can bend the beam all the way back to the Earth's surface, so a surprising radar blip turns out to be a hill or a building. With the introduction of more advanced filtering software over the past decade, the number of UFOs attributed to false returns has decreased significantly.

Former Air Force pilot, astronomer and longtime UFO skeptic James McGaha believes that some such form of radar scatter was responsible for the returns that MUFON interpreted as a solid object. The FAA did not describe any such object, nor was it clear

whether it was in the Brownwood MOA. “They had a huge amount of data,” McGaha says, “and they just pulled a few bits of information out of it and drew a line.”

In the fall, just when it seemed as though Stephenville might be forgotten, the sightings began again. People were no longer hesitant to come forward. Their descriptions often compared the lights to arc welding or burning magnesium—lights bright enough to interrupt a little league football game in Stephenville. The descriptions followed a pattern similar to the one

experienced by Peggy Delavergne. On the night of Nov. 18 she saw lights while driving her children home to Stephenville after a basketball game in Dublin. “At first there were two very bright gold lights,” she says. “Then there were more lights, like a string of pearls—not quite a circle and not quite egg-shaped. My husband was in another vehicle, and he saw them too. He called me on his cellphone and asked me, ‘Do you see that?’ I don’t know whether it was from somewhere else or from the military, but something is going on out there.”

A high school student named Carli

Crutcher shot a photo of the lights that Mac McKinnon ran in the *Dublin Citizen*. It shows streaky, stringy forms.

WHAT'S IN THE SKY? SOME SKEPTICS, like McGaha, believe that the Stephenville, Phoenix and many other sightings can be attributed to military aircraft and evasion or illumination flares.

Flares have a long association with UFO sightings. One night in late February 1942, the sky over Southern California lit up with strange blinking lights near various defense plants. In what has become known as the Battle of Los Angeles, the Navy unloaded four batteries of antiaircraft artillery at what turned out to be a balloon carrying a red flare. A decade ago, mysterious lights seen by thousands of Phoenix residents were actually leftover flares dumped by A-10 pilots with the Maryland Air National Guard.

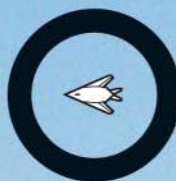
Some Erath County residents dismiss the flare theory. "I've seen military flares," Allen says. "They are not even the same color as the ones I saw." But evasion-flare technology evolves rapidly, as the military tries to keep one step ahead of the increasingly sophisticated tracking capabilities of antiaircraft missiles. At one time evasive maneuvers consisted of sharp turns against the sun. When missiles got smarter, pilots began dropping bright flares; infrared seekers homed in on the decoys while warplanes fled from the field of view.

But today's missiles can track far more than the heat signatures of engines. They can pick out targets among decoys by discerning a warplane's movement and shape. Spectral sensors on missiles can even detect the color differences between a jet engine and a flare. In response, the military has deployed a variety of flares that can move under their own power and change color.

People in Erath County are certainly familiar with warplanes. During my

ON FURTHER REVIEW ...

TOP-SECRET AIRCRAFT



Spy and stealth planes—some with bizarre, bat-shaped wings, others with triangular silhouettes that imply otherworldly designs—have long generated UFO

sightings and lore. And official denials feed rumors that the government isn't telling us about alien ships. The CIA estimates that over half of the UFOs reported from the '50s through the '60s were U-2 and SR-71 spy planes. At the time, the Air Force misled the public and the media to protect these Cold War programs;

it's possible the government's responses to current sightings of classified craft—whether manned or remotely operated—are equally evasive. The result is an ongoing source of UFO reports and conspiracy theories. Here are the Earth-built craft that likely have lit up 911 switchboards over the years.



1

RQ-3 Darkstar
Lockheed Martin/
Boeing



- **First Test Flight:** 1996 • **Deployment:** None (it was canceled in 1999) • **Declassified:** 1995 • **Size:** 15 ft long; 69-ft wingspan
- **Performance:** 288 mph (cruising speed); 45,000+ ft (max. alt.)
- **UFO Link:** The official life span of this unmanned spy plane was brief and disappointing, with a crash and a program cancellation after just three years. But in 2003, *Aviation Week* reported that a similar stealth UAV was being used in Iraq—fueling speculation that the government scrapped the craft publicly only to secretly resurrect it for clandestine missions.

2

U-2 Lockheed Martin



- **First Test Flight:** 1955
- **Deployment:** 1957 to present
- **Declassified:** 1960
- **Size:** 49 ft long; 80-ft wingspan
- **Performance:** 410 mph (max. speed); 85,000 ft (max. alt.)
- **UFO Link:** Designed for high-altitude reconnaissance, the U-2's long, gliderlike wings and silver color would have been notable to observers on the ground and in the sky. In the 1960s the airplane was painted black to avoid reflections. The U-2 is also famous for being among the first classified planes to be flown from the Air Force's secret test facility at Groom Lake, Nev.—aka Area 51.

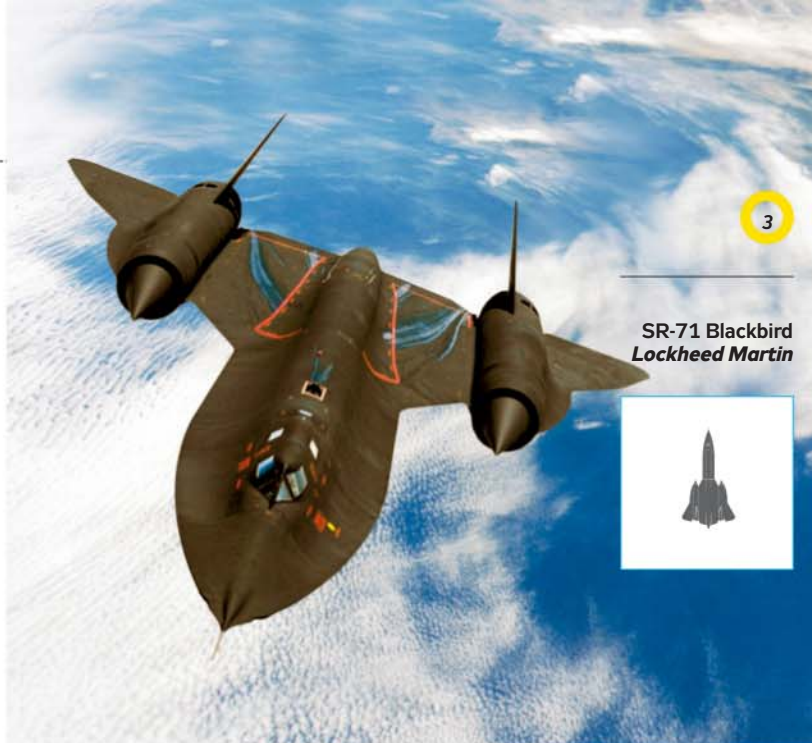


3

SR-71 Blackbird Lockheed Martin



- **First Test Flight:** 1964
- **Deployment:** 1966 to 1990, 1995 to 1998
- **Declassified:** 1964
- **Size:** 107 ft long; 56-ft wingspan
- **Performance:** 2432 mph (max. speed); 85,000 ft (max. alt.)
- **UFO Link:** The tailless spy plane has an even more unusual cross section than the U-2. This Area 51 alum was briefly reactivated in the 1990s, and rumors of a followup—the now-legendary Aurora project—have supplied both UFO believers and skeptics with a possible source of unexplained sightings.



4

P-791 Lockheed Martin



- **First Test Flight:** 2006
- **Deployment:** Unknown
- **UFO Link:** Plane spotters' photos and videos blew the top-secret cover off a 5-minute inaugural flight in Palmdale, Calif. The hybrid airship—it uses gas and a wing shape for lift—fuels speculation that classified airships quietly roam the night skies.



5

F-117A Nighthawk Lockheed Martin



- **First Test Flight:** 1981
- **Deployment:** 1983 to 2008
- **Declassified:** 1988
- **UFO Link:** This long-range stealth fighter, which could stay aloft indefinitely thanks to midair refueling, remained classified through much of the 1980s during test flights at Tonopah Test Field Range in Nevada, 80 miles from the legendary Area 51 Groom Lake facility. Along with the B-2 Spirit, the batlike F-117A was a perfect candidate for triangular UFO sightings.



6

B-2 Spirit Northrop Grumman



- **First Test Flight:** 1989
- **Deployment:** 1997 to present
- **Declassified:** 1988
- **Size:** 69 ft long; 172-ft wingspan
- **UFO Link:** Although the long-range bomber was never a true "black aircraft," since it was displayed to the public approximately eight months before its first flight, an airborne B-2 is a UFO report waiting to happen. It looks like an alien craft from nearly any angle and specifically like a flying saucer when viewed head-on or in profile.





NATURAL NIGHTLIGHTS

The skies over Earth are home to regular displays of bizarre natural lights that could be mistaken for UFOs.

- **VENUS:**

It's responsible for the greatest number of sightings—including one by Jimmy Carter in 1969. The planet usually appears just above

the horizon around dusk or dawn; it trails only the moon in luminosity; and depending on the air mass in front of the viewer, the planet can be magnified into a ball or seem to skip around. World War II pilots mistaking it for a Japanese plane once shot at it.

- **PLASMA:**

Some 60 miles up, electrons that shower the atmosphere interact with neutral atoms and release bursts of photons. In 2006, the United Kingdom's Defence Intelligence Staff concluded that the resulting aurora generates a number of the country's annual sightings.

- **METEORS:**

About 25 million pass through the atmosphere daily—some resulting in showy midair displays that have been mistaken for UFOs since as early as 1965, when residents of Kecksburg, Pa., were bewildered by a meteor.

- **LENTICULAR CLOUDS:**

Stratified and saucer-shaped, they tend to form near mountains. In July 2008, the *North Wales Pioneer* ran a resident's "strange images"—of a lenticular cloud.

Leonid meteor blast on Nov. 18, 2001, left this eerie ring.

Camera Effects

The most provocative imagery to emerge from the Stephenville sightings came from resident David Caron, who videotaped squiggling, multicolored lights on Jan. 19, 2008, that he says must have been a UFO (below, left). "You could see it much better through the camera than just with the naked eye," he told the Stephenville *Empire-Tribune*. That might have been the problem. "Video cameras record at about 30 frames per second," says George Reis of Imaging Forensics. "This recording refreshes twice per second, so very long exposures are being used." Caron was likely filming a distant, stationary light. "A handheld exposure of a bright light results in light streaks from camera movement that would look like these images," Reis says. The color shifts, he adds, may be from color mosaic filtration on the camera's CCD chip. The History Channel's *UFO Hunters* reproduced a similar effect with a video camera set to night mode zoomed in on a cluster of colored lights across the lab (below, right). UFOlogists on Internet forums did the same by shooting the star Sirius, which is known for its luminescence and vivid coloring.



Screen grabs: David Caron's (above, left), and the History Channel's re-creation.

visit, I get a taste of the 3200-square-mile Brownwood MOA in action. Helicopters and jets fly day and night. One afternoon, while I'm driving to Dublin on Highway 377, a T-38 Talon supersonic jet trainer rips past only a few thousand feet above the road.

The MOA is well-known to the leading civilian authority on Texas airspace, Steve Douglass. The author of *Military Monitoring* and an expert consulted by *Aviation Week*, Douglass has been tracking operations from his base in Amarillo for a quarter century. He is part of the so-called interceptors network, the plane spotters caricatured in the film *Broken Arrow* as "those guys in lawn

chairs" staking out runways and bases. "Brownwood is used by Navy, Air Force and Army units," Douglass says, "including Apache helicopters, B-1s, C-130s and F-16s. There are AWACS from Tinker AFB in Oklahoma City and KR-135 tankers from Altus in southwest Oklahoma. The airspace is especially active these days, with the new F-35 tactical fighter being assembled at a factory in Fort Worth and tested in the MOA." Lockheed Martin spokesman John Kent confirms that on Jan. 8, 2008, the first—and

until June 2008, the only—F-35 test plane, the AA-1, was in Fort Worth, but it was not in the air that night. "It's restricted to daytime flight," Kent says, so that chase planes can monitor it.

STEPHENVILLE IS ONLY THE LATEST IN a long list of UFO incidents that are likely based on military operations, starting with the Battle of Los Angeles. Whether the recent Texas sightings were flight exercises involving evasion flares or tests of an existing plane, a new plane or a UAV, any military activity in the area is likely to remain unexplained for awhile. We now know about the secret programs behind the UFO sightings of decades ago. But what of programs that are still secret?

In the past, many projects sponsored by DARPA, which was behind the original Stealth and UAV research, have begun as secret black programs before showing up as public white ones. One example: stratospheric sensors developed for high-altitude airships under the ISIS program, which may have existed for years before it was made public in 2004. (Its funding for 2007 was \$24.7 million.) These sensors could be used on huge wing- or boomerang-shaped blimps that can fly at altitudes of more than 60,000 ft and hover unmanned for months. "There have been many sightings of large, slow-moving triangle-shaped airships," says Steve Douglass, "starting with a sighting near Antelope Valley, Calif., in 1990." For many years airliners and ground observers have reported boomerang-shaped craft near Groom Lake.

The tethered "aerostat" lighter-than-air craft, which appeals to many agencies as a so-called poor man's satellite, also may trigger sightings. The Air Force uses these surveillance systems along the U.S.-Mexico border to support antidrug operations. The departments of Defense and Homeland Security are evaluating

JON AWBREY
Reporter

"As far as what I saw, it was probably military. Think of the secret aircraft in the '60s; we have no idea what they're producing now. And they're never going to tell us."



ON FURTHER REVIEW ...



TOP 10 UFO HOTSPOTS



Where is UFO country? To find out, PM consulted the Center for UFO Studies, which maintains a database of sightings reported from 1947 to 2005. Illinois-based CUFOS gathers data from UFO reporting groups and public records, including Project Blue Book. (If several people report the same sighting, CUFOS registers it as a single event.) For a broad comparison, we ranked both metropolitan and more sparsely settled counties. Why did these 10 top the list? Perhaps because some are close to military training zones called Special Use Airspace.

An uptick in sightings over **Santa Rosa County, Fla.**, could stem from the presence of an air wing that tests every fighter, bomber, unmanned aerial vehicle and weapon in the Air Force inventory. Military refueling lanes crisscross the nation, and lights from air tankers and warplanes flying at night in close formation could appear as triangles of light from the ground. Psychology may also play a role. Westmoreland County, Pa. (pop. 362,326), which records more sightings than the metro Houston area (pop. 3.9 million), includes Kecksburg, the location of a reputed 1965 UFO crash. Residents there may be more likely to report strange lights to a UFO group.

REPORTED UFO INCIDENTS (1947–2005)

Major Metro Counties
1 Los Angeles, CA: 1346
2 King, WA: 621
3 Cook, IL: 468
4 Maricopa, AZ: 424
5 San Diego, CA: 348

Less Populated Counties:
1 Westmoreland, PA: 396
2 Saguache, CO: 263
3 Santa Rosa, FL: 242
4 Yakima, WA: 227
5 Rockingham, NH: 183

LEGEND

Special Use Airspace
 Military Refueling Flight Paths

unmanned inflatables 500 ft long.

The military's secrecy exasperates some Stephenville locals, even veterans. "It's been 30 years since I was in the Air Force," James Huse says, "but I don't understand why they wouldn't come out and tell the truth. If they have the capability of putting on a show like that all they have to do is tell us. We'd get out our lawn chairs and watch."

But the Air Force's legitimate need for secrecy extends beyond its black programs. It releases information about all domestic flights on a case-by-case basis, says Capt. Rose Richeson, of the USAF Air Education and Training Command. "Usually we don't mind talking about training," she says. "But we would not talk about specifics if it were a matter of national security, or give details about training methods or mission scenarios that could be used by enemies of the United States."

Meantime, Stephenville has settled uneasily into its newfound notoriety as a UFO site. Some locals have become skeptical about the motives of MUFON. "Who funds it?" asks Steve Allen. And a certain amount of backbiting has set in among some of the eyewitnesses. Lee Roy Gaitan worries that some locals who have reported sightings are "just not credible" and cast doubt on his genuine account. "Some people stretch a story," Huse says. Others resent the way they have been depicted. "I made the mistake of saying it was as big as a Wal-Mart," Allen says. "People have been teasing me about it ever since."

"I didn't call them flying saucers or extraterrestrials," Huse says. "All I said was that it was unidentified flying objects, and I'm sticking to that. I couldn't identify them." People in Erath County, Huse says, aren't nuts or hicks. "We are just ordinary people who happened to look up."

PM



MAGNETIC NORTH HAS GUIDED
TRAVELERS FOR CENTURIES.

OUR MAGNETIC DOCKING FAUCET,
HOWEVER, IS HAPPY TO STAY
WHERE IT BELONGS.

Goes far when you need it, stays put when you don't. It's the Delta® faucet with MagnaTite™ docking and it's a new solution to an age-old problem. With a powerful magnet built into its pull-down spray head, there's no need to worry about it staying docked when it's not in use. It's one of the many ideas that make Delta® more than just a faucet.



see what Delta can do™



ALLORA®

A high-angle, close-up photograph of a person's hands and arms as they use a power tool, likely a rotary hammer, to demolish old floor tiles. The person is wearing a black t-shirt and a black wristband. The floor is covered in a large pile of broken, reddish-brown and patterned tiles. A green power cord is visible on the left. In the bottom center, the top of a white bucket is partially visible.

BASEMENT REPLACEMENT

A creative renovation can turn even the most subpar subterranean room into a comfortable retreat.

→ by **Harry Sawyers** → photographs by **Scott Jones**



BEFORE



1



2



It's hard to pinpoint the worst part of Danny Tracewski and Courtney

Jansen's pre-renovation basement **(1)** in Brookhaven, Pa. The rickety bar comes to mind, with its sticky, matte black counter surrounded by mustard-colored brick and sooty gray grout. Or there's the foam drop ceiling with knobby plastic fluorescent fixtures and, beneath it, an industrial brown carpet best suited for indoor soccer. The couple wanted a space where they could work and entertain guests. Instead, says Jansen, "We're afraid to go down there."

When HGTV's James Lunday and his *Rip & Renew* team first looked at the basement, they saw unrealized potential. The lifelong carpenter and his renovation crew typically tear a place apart and start from scratch **(2)**, rebuilding with inexpensive materials that they customize to overcome a room's limitations. In this case, Lunday explains, "We used light and dark to create depth and give the illusion of a high, wide space." Says Jansen, "Now, we spend pretty much all our time down there." [POPULAR MECHANICS tagged along to see how they pulled it off.](#)





3



4

→ MANAGING MASONRY

Unfinished masonry can often pose a problem when converting a basement to a living space—exposed foundation walls may need to be masked, and ugly brick or tile may have to go. The couple, who described their basement's brick as "awful," dealt with both issues.

Hammer It Tearing down nonstructural brick and ripping up old tile are the types of jobs that call for renting a compressor and pneumatic demolition tools, such as an air hammer and chisel. The *Rip & Renew* crew also used a sledgehammer to knock loose bricks from the wall supporting the bar (3).

Hide It Removing structural brick in a basement can be impossible, as was the case with the knee wall ringing the room's perimeter. To conceal it, contractors mounted



5

1 x 2-in. lath on the brick vertically using concrete anchors. The lumber became a base for mounting plywood or drywall. Two design elements added a feeling of height: Fluorescents concealed beneath the plywood cast light upward (4), and a stained plank Lunday calls a beer shelf caps the knee wall (5).

→ DEALING WITH DROP CEILINGS

"When things in a home go wrong, they often go wrong in the basement, between floors," Lunday says. Drop ceilings allow access to critical plumbing and electrical lines, but they haven't traditionally been an attractive solution. Fortunately, drop ceiling design has steadily improved. Even if a basement is not ready for a full renovation, replacing the ceiling can provide dramatic change.

Pull Out the Old Track

New ceiling panel dimensions meant that Lunday (center) couldn't reuse existing track (6).

Hang the New System

The crew mounted new ceiling track intermittently to joists using twisted wire and metal hardware (7). The supports wouldn't be visible, so Lunday could install them quickly.

Mount Recessed Lighting

Fluorescent tube lighting can make a bad drop ceiling worse. The *Rip & Renew* crew installed standard round recessed-can fixtures throughout Armstrong's 2 x 2-ft raised ceiling panels (8). Using templates that came with the lights, the crew cut the panels with a utility knife to fit the fixtures, and decorative flanges hid the knifework.



9



10



11



6



7



8



AFTER

→ MAXIMIZING A SMALL SPACE

Confronted with a shoebox-shaped room, Lunday chose finishes that would maximize the small, squat area. The light maple floor adds brightness and warmth, while low-slung furniture keeps lines of sight clear. He calls the result “industrial modern meets a country living room.” While specific to this basement, his solutions use principles that apply to any long, low space that needs to be made more livable.

Divide Public From Private By hanging three hollow-core doors from an overhead ceiling track, Lunday created a room-dividing screen. This separates a private office area from the media room. The doors slide on casters in a track that Lunday mounted to joists before the drop ceiling was installed (9). The crew routed $\frac{1}{8}$ -in.-deep vertical lines into the doors and darkened them with a stain pen.

Use Functional Furniture Made of a solid door, the desk folds up, Murphy-bed-style, on a pair of chains (10). As a result, it provides ample work space when needed, but also tucks out of the way when the couple wants to entertain guests in their brand-new basement (11). **PM**



ON THE WEB > Find more basement solutions at popularmechanics.com/home_journal.

+ *Classic* **DIY**

Roy

WHAT WE USED
Anvil

**Ridgid Peddinghaus
Model 12** Strike hot metal
on this 275-pound anvil and it
rings like a bell (ridgid.com).

PM editors Roy Berendsohn
and Mike Allen have framed
houses and built race cars—
but forge steel in the garage?
That was something new.



Mike

by Roy Berendsohn
photographs by Brad Paris

the Backyard Blacksmith

Men have been heating and hammering metal for 10,000 years. We figured it was high time we learned how too.

*

If you want to work with metal, there's one thing you have to confront: You need heat. With it, you can make the toughest metal submit to your will. Without it, you'll never gain full mastery over this stubborn material.

Over the years, I have been frustrated by my inability to work hot steel. I've bolted metal together, welded it and soldered it. But I couldn't shape it, and so large swaths of the mechanical realm were off-limits to me.

But blacksmithing never felt alien. My father is a metallurgist, descended from generations

of 19th-century blacksmiths and born in Germany to shipbuilders whose forges scattered sparks over the shores of the Elbe River and the North Sea. I grew up in rural Connecticut among Yankee mechanics who could forge anything, machine anything, build anything, fix anything—and I’ve been trying to live up to those old-timers’ standards all my life. It wasn’t hard to finally decide to take another step, and teach myself some blacksmithing skills.

Building the Forge

Maybe it’s because our smokestack industries are in decline that a rising number of Americans feel the need to get their metalworking fix in home workshops. The Artist-Blacksmith’s Association of North America counts a membership of 4000 hobbyists and professionals. Some people estimate there are more blacksmiths in this country today than there were during the 1800s. And you don’t have to poke around long to find dozens of Web sites offering friendly—even passionate—advice from artisans, along with equipment ranging from anvils and tongs to air-driven power hammers.

First, I needed a forge. I considered buying a gas-powered model, but the fact was that I wanted to build my own. So I settled on a design that can be executed in an afternoon using parts purchased at a home center, a masonry supply yard and an auto parts store. The forge would burn coal, rather than gas, to make things simpler. And the design had another virtue, at least as far as I was concerned. It was based on plans published in *POPULAR MECHANICS* in July 1941.

I enlisted the help of Mike Allen, our senior auto editor and a crack metalworker. He glanced at the old plans and said, “Sure, we can build this.” Within days, Mike’s house and the shop behind it swirled with activity as the UPS guy delivered in rapid succession a 275-pound anvil, tools, materials and four 50-pound boxes of blacksmith’s coal shipped from Pennsylvania.

Once the supplies were in, we set to work building the forge, beginning with its stand. I cut steel parts and handed them off to Mike, who laid them out on the shop floor, clamped them together and temporarily tack-welded them with small globs of steel.

With the stand tacked, he flipped up his mask

and handed me the welding gun: “You take it from here.” I slid on a mask and picked up where he’d left off. As I worked, Mike crouched over my shoulder and fired off bits of advice. “Get more weld metal on the vertical surfaces,” he said. “You’re getting too much spatter; reduce your travel speed and your electrode stick-out.” When I found it difficult to see through



(July 1941)

the welding glare and smoke, he said, “Deal with it. Look at the weld puddle, not the arc.” I learned more about welding in that half hour than I had in years of fooling around on my own.

After we completed the stand, we riveted sheetmetal into a hood and fashioned a chimney from a 5-ft piece of stovepipe. Then, we troweled refractory cement (the kind used in furnaces and kilns) into the sink. We ran steel and PVC pipe from the drain to the output port on a shop vacuum. The same line would supply air both to the sink (to feed the fire) and, through a Y joint, to another pipe leading into the chimney (to help pull the smoke up and away). We installed a valve to let us direct the air where we wanted it. We also cut pressure-treated 4 x 4 lumber to make a block for the anvil, then hoisted the anvil onto the block using a tow strap hooked to a ceiling-mounted electric winch. Finally, we hammered ½-in.-thick steel flat stock into straps to attach the anvil to its block. Believe me, 15 minutes spent pounding cold steel can convince anybody of the need for a forge.

Now we just had to let the furnace cement cure overnight.

Firing the Coal

I arrived at Mike’s shop early next morning to find him puttering around, a cup of coffee in hand and another, recently poured, waiting for me on the workbench. “Ready for fire?” he asked.



WHAT WE USED

Forge

A two-basin stainless-steel sink serves as the center of our blacksmithing setup. One basin is filled with water, forming a quench tank. The other is lined with furnace cement, then covered with firebricks laid in place without mortar. A cast-iron floor-drain cover laid over the sink's drain forms the tuyère, the port where a blast of air (supplied by a shop vacuum) enters the coal bed from below.



ON THE WEB

We've updated PM forge plans first published in 1941.

See popularmechanics.com/forge.

WHAT WE USED

Refractory Cement, Brick

Rutland Fire Clay Black Furnace Cement was troweled into the sink to protect it (rutland.com). Firebrick is sold at masonry centers.

Forge Fuel

Penn Keystone Coal sells clean-burning bituminous and anthracite blacksmith's coal in 50-pound bags protected by a cardboard box. One pound offers an astonishing 14,373 Btu. penncoal.com

Hood and Vent

Twenty-gauge sheetmetal and a 5-in. galvanized stovepipe formed the forge's hood and vent. The materials are commonly available at home centers.



+ Classic DIY

WHAT WE USED

Striking Tools

Plumb's 48-ounce blacksmith hammer (seen here) is complemented by a 40-ounce ball-peen hammer.

coopertools.com

WHAT WE USED

Tongs

Wolf-jaw tongs are a general-purpose tool, and the best choice for beginning smiths.

blacksmithdepot.com

BASIC SKILLS

Bending

Place hot metal over the horn to make a gracefully curved bend. To make a right-angle bend, use the width of the anvil's face.

Twisting

Secure a heated bar in a vise and turn one end with a wrench. If you're twisting stock with a rectangular cross section, place a short piece of pipe over the stock to prevent distortion as you twist.

Upsetting

Heat the end of a bar and place its hot end down on the anvil's face or on the upsetting block that projects from the base, if your anvil has one. Drive the bar into the anvil by striking the cold end. This thickens the hot end, transforming it into a bulbous shape.

Flattening

Lay the bar across the anvil's width to flatten its end. To straighten and flatten a bent bar, lay it across the anvil at an angle.

CHOOSING STEEL

Low-carbon steel (top) is fine for most projects, but high-carbon, S7 tool steel (bottom) is better for shaping implements that need to hold an edge.

We carried the forge outside and in a light autumn wind used a propane torch to ignite crumbled shipping paper and kindling split from the pallet the anvil was shipped on. When the fire was bright and hot, we coaxed some coal onto it, and watched anxiously as it gave off a faint, yellow-green, sulfurous smoke. We added more fuel. The fire smoldered stubbornly, but when we turned on our high-powered vacuum, the blast of air knocked our little coal pile out of position. We pushed the smoldering pieces back with a steel bar and tried again, without success.

Mike grabbed an air hose and nozzle from his shop compressor and applied a gentle draft. Now the coal started to glow. We added more fuel, and the smoke nearly disappeared. We turned on the shop vacuum again. With that, an impressive rushing sound came up from the forge, and the center of the coal mound reddened like a stoplight. A few moments later, a bright yellow flame jumped from the fuel, and then a ghostly blue glow took shape above it. As it hovered, the blue light looked like a living thing.

Once the coal was burning well on its own, I took a piece of scrap metal from the shop floor and wiggled the steel into the volcanic fuel bed. A couple of minutes later, we slid the metal out to find that it had merely turned a light shade of blue—still not enough heat. Mike rotated the valve to make the vacuum's entire air output rush into the fire, feeding the flames. (This is where the old blacksmithing term “full blast” comes from.) We watched in awe as a yellow-white glow took shape in the center of the coal, and the steel was lost in the glare. The light was too intense to look at without shaded eye protection.

Working the Steel

A couple of minutes later, I picked up my tongs and withdrew the steel. The end was now glowing bright yellow and spitting sparks—the temperature must have been up around 1900 F. I laid

the metal over the anvil's edge and picked up our 48-ounce blacksmith hammer. A few whacks were all it took to put a neat bend in the bar.

After decades spent struggling with hacksaws and rivet guns, I can't tell you how gratifying it was to put a hammer to glowing steel and bend it like putty. Mechanical justice was done.

A long day followed as Mike and I practiced the basics of the blacksmith's age-old craft: bending, flattening, twisting, tapering and upsetting—striking a bar to thicken and enlarge its hot end. We used angle iron to form the best coal-handling tool I've seen—a curved fire poker worthy of a shipyard's smithing shop. And we felt sufficiently emboldened to try our hand at forging a demolition chisel from a 3/4-in.-dia bar

of tool steel, a high-carbon material far tougher than the stuff found at hardware stores. We had to let the steel soak in the forge fire three times and swing the hammer for several minutes before it began to yield.

At sundown, we called it quits and let the fuel bed cool into ash. We swept the shop floor and put

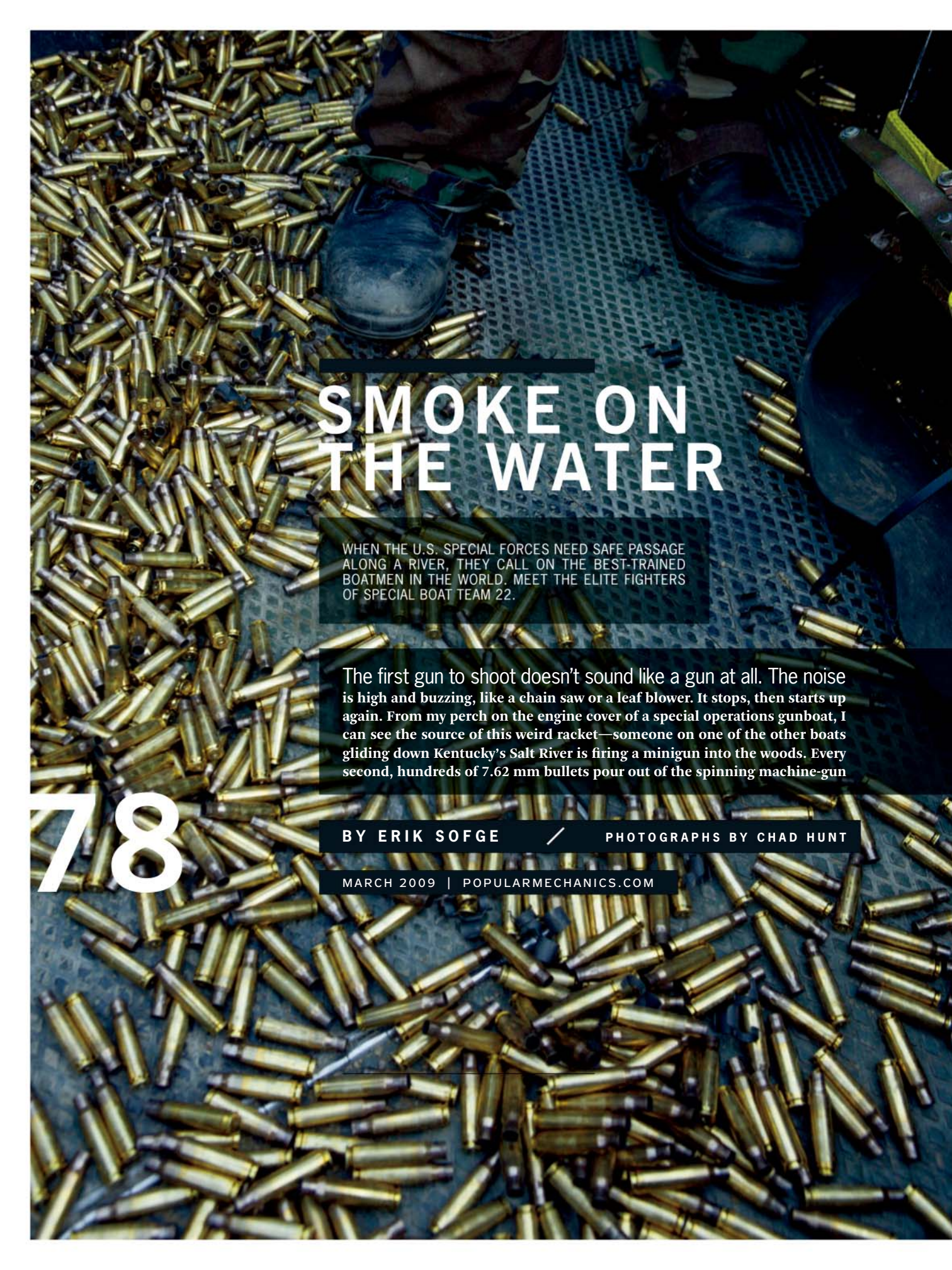
away our tools for the night, already planning future projects. Teaching ourselves forge construction and basic blacksmithing in two days was a good piece of work. But Mike had plans for a serpentine iron rack to store motorcycle helmets, while I wanted another go at shaping my own tools, designed uniquely for my needs. That's how I imagine the Iron Age was launched in prehistory, in a forge like the ones archaeologists have found scattered throughout Africa and the Middle East. Some guy needed a better tool, and figured out a way to make one.

It was dark by the time I dropped into the seat of my car and headed home. As I merged onto the highway and into a traffic jam, I saw the taillights of the cars ahead in a new way. Just for tonight, they didn't represent a hassle. They looked like a gigantic bed of glowing coals, waiting for its steel.

PM

We watched in awe as a yellow-white glow took shape in the center of the coal, and the steel was lost in the glare. The light was too intense to look at without eye protection.





SMOKE ON THE WATER

WHEN THE U.S. SPECIAL FORCES NEED SAFE PASSAGE ALONG A RIVER, THEY CALL ON THE BEST-TRAINED BOATMEN IN THE WORLD. MEET THE ELITE FIGHTERS OF SPECIAL BOAT TEAM 22.

The first gun to shoot doesn't sound like a gun at all. The noise is high and buzzing, like a chain saw or a leaf blower. It stops, then starts up again. From my perch on the engine cover of a special operations gunboat, I can see the source of this weird racket—someone on one of the other boats gliding down Kentucky's Salt River is firing a minigun into the woods. Every second, hundreds of 7.62 mm bullets pour out of the spinning machine-gun

BY ERIK SOFGE

PHOTOGRAPHS BY CHAD HUNT

MARCH 2009 | POPULARMECHANICS.COM

78



A live-fire exercise on Kentucky's Salt River offers a rare window into the secretive, dangerous world of the Pentagon's black-ops boat crews.

barrels. I'm pushing up my helmet, trying to spot the gunners' targets, when someone close by yells "Contact," and the boat I'm sitting in erupts in gunfire. Now the shell casings are landing in my lap as twin M240B machine guns rattle a couple of feet away. When the aft-mounted .50 caliber starts thumping, the pressure from each shot feels like a punch in the gut.

The volume of fire builds as two other Special Operations Craft-Riverine (SOC-R) boats join in, but no one is shooting back. This is a live-fire exercise at Fort Knox—and the thousands of rounds tearing through the air on this day are all outbound. The torrent of gunfire does not seem to rattle the members of Special Boat Team 22.

Many of these Special Warfare Combatant-craft Crewmen, or SWCCs, have survived firefights along the Tigris and Euphrates rivers in Iraq. Fast, heavily armed SOC-R boats are used mainly to insert or extract Navy SEALs, Army Rangers and other special forces personnel. If the enemy interferes, the SWCC response is, in military speak, "violence of action." The SOC-R's five weapon mounts provide a 360-degree field of fire. "Anyone who decides to shoot at us will immediately regret that decision once we start shooting back," says Mike, my designated SWCC spokesman, his face patterned with green and black grease paint. "We have an overwhelming amount of firepower at our disposal. It's pretty insane."

A fog of gun smoke builds over the river as the boat crew fires, and when I inhale, the smoke burns the back of my throat. It's no longer possible to make out the demolished

targets or even the foliage on the riverbank.

This one-sided engagement has already covered the floor of the 33-ft-long boat with hundreds of spent casings. But the simulated fight isn't over yet, even as the diesel engines throttle up and the boat speeds off. The aft gunner continues to rattle away on the .50-caliber, and clouds of dirt are still blooming on the offending bank.

SHADOW FIGHTERS

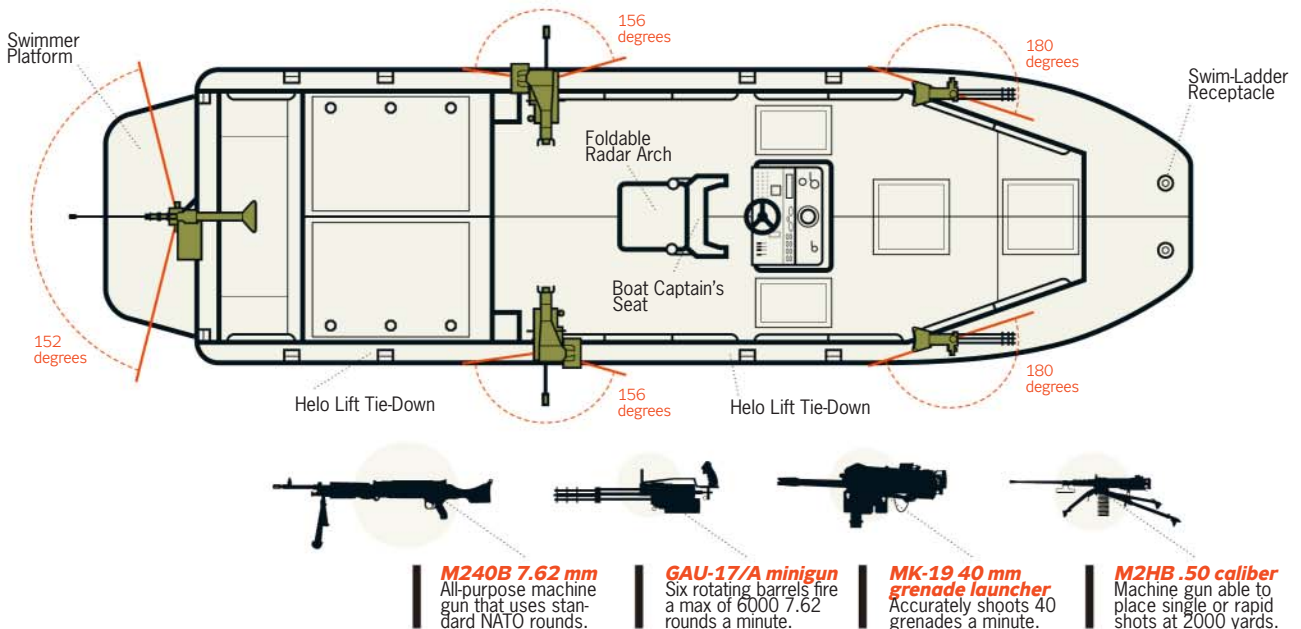
There's a good reason SOC-R boats bristle with machine guns: Riverine craft fight in extremely close quarters. The enemy could be 20 yards away, crawling along the river's edge. Other than the boat captain, who sits in a shielded compartment while driving, the crew is almost entirely exposed. A well-coordinated ambush could wipe them all out within seconds. Although SOC-R boats are highly maneuverable, avoiding a fight while on a narrow river isn't always an option. "Your best defense is to shoot," Mike says.

Members of Special Operations Forces (SOF) involved in fieldwork never release their full names to the



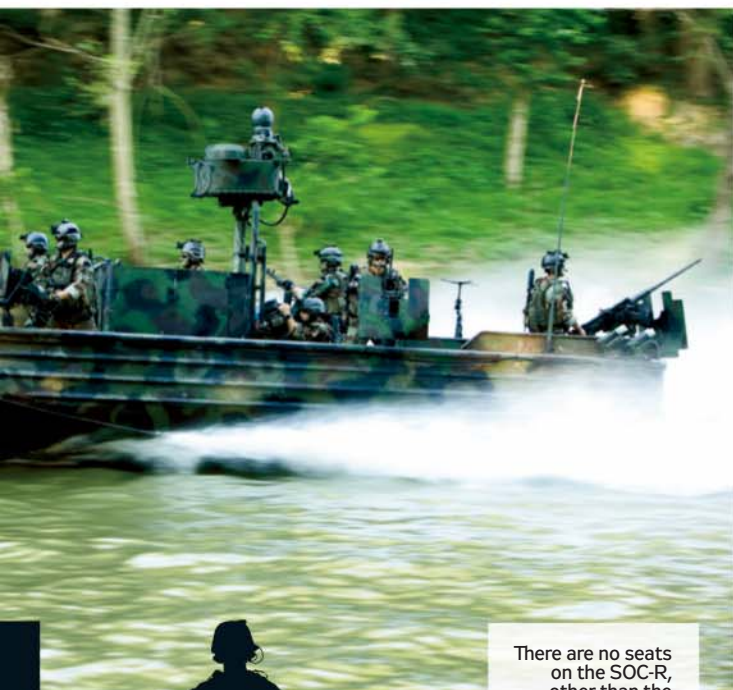
FAST-MOVING FIELDS OF FIRE

Special operations gunboat crews prefer to stay out of the fight but are equipped to win it if need be. Each craft can apply an array of withering fire in any direction. They have a variety of interchangeable mounted weapons to choose from, and carry personal arms in case crew members fall—or must flee—from the boat.



press. SWCCs are in the same multibranch military family as Green Berets, Rangers and SEALs, and all are considered by the Pentagon to be “high-value targets,” meaning they could be personally targeted by the nation’s enemies. (Officials won’t say whether any SOF has ever been stalked in such a fashion.) During our live-fire ride-along, the restrictions on what we can describe extend to communications gear, the armor on the SOC-R hulls, tactical maneuvers and details of the boat-mounted sensors.

Special operations boat crews trace their heritage through



Special Warfare Combatant-Craft Crewman

There are no seats on the SOC-R, other than the boat captain’s in the center. The Pentagon overhauled SWCC riverine craft for clandestine missions in 2002, replacing Vietnam-era gunboats.



Sig Sauer P228

This reliable 9 mm pistol is a favorite in special ops circles.



Special Ops Peculiar Modification M4A1

A black-ops kit can add a noise suppressor, day/night scope and laser spotter to a standard rifle.

Vietnam-era Swift boats back to the regular-Navy PT boats of World War II. Unlike those predecessors, SWCC units do not patrol, but instead train allied troops and participate in targeted raids. (The older units also didn’t parachute from transport airplanes with their boats, the way SWCCs do.) Training is intense: Aspiring crewmen are expected to be able to perform 79 sit-ups in 2 minutes and swim 500 yards in 10 minutes. Their physical strength is needed to handle heavy gear—each crewman wears at least 70 pounds of ballistic protection, weapons, radios and medical gear—and also prevents injury. But physical conditioning doesn’t totally prevent back damage caused by the repeated impact of fast-moving boats slamming across waves. Many veteran SWCCs have scars from back surgeries made necessary by these shocks to their vertebrae.

The military won’t discuss specific SWCC missions, but it will say that SOC-R teams have faced heavy, regular action along the river systems of Iraq. “They’re out there, and they’re engaging,” says Rich Evans, Naval Special Warfare Group 4 command master chief. “There’s been a couple of missions that ended up in the largest firefights that guys on the water have been in since Vietnam.”

Since Sept. 11, 2001, the Special Forces have received an increasing share of personnel and funding—the SOF budget rose by more than 80 percent between 2001 and 2006. Evans says that the number of SWCCs is growing at a fast pace because of bureaucratic changes within the Defense Department. In 2006 the Pentagon changed the “source rating” of the SWCC’s units—the military equivalent of making a short-term civilian job into a permanent position. Now, “most guys who get into naval special warfare stay in,” Evans says. “They don’t go back to the fleet.”

The majority of the 650 total SWCC members, split into East and West Coast teams, conduct operations on coastal vessels (see page 82). Members of Team 22, based in Stennis, Miss., who make up a tiny fraction of the total SWCCs, are the only ones who operate the SOC-R. These river crews conduct mainly clandestine combat missions, often operating at night with little or no air support. Coastal teams, in contrast, spend more of their time these days training friendly international forces. “In the schoolhouse at SWCC school, you can choose which team you want to be on,” Mike says. “I specifically picked [Special Boat Team] 22, because it’s the most up-close-and-personal, aggressive team that the SWCCs have. I mean, you’re on a river, you’re a lot closer to any enemy; whereas, you know, it’s a huge ocean.”

AMERICA'S MOST HEAVILY ARMED VEHICLE

The SOC-R wasn’t made to be versatile. Instead, it is a specialized tool built to help the SWCCs engage the enemy in tight surroundings—and prevail. The SWCCs told its builder, United States Marine, of Gulfport, Miss., that the craft could have a draft no deeper than 2 ft when fully loaded with armaments, ammunition, crew and passengers. It had to be compact enough to fit inside a C-130 military aircraft, narrow enough to slide through tight river passages and light enough to be hoisted by a Chinook helicopter. In Iraq, the helicopters



OTHER NAVAL SPECIAL-WARFARE BOATS



MK V Special Operations Craft
SEALs in a small inflatable boat can access these medium-range Mark Vs using a ramp on the stern. In addition to Special Operations Forces (SOF) delivery, Mark Vs are used to intercept and board enemy vessels and to launch unmanned aerial vehicles.

***Length: 81 ft 2 in. Max Speed: 48 knots
Range: 500+ nautical miles Hull: Aluminum***



NSW Rigid Inflatable Boat
The primary mission of these extreme-weather craft is the short-range transport of SOF to and from enemy beaches. They also conduct recon and resupply.

***Length: 36 ft 0 in. Max Speed: 45+ knots
Range: 200+ nautical miles Hull: Glass-reinforced plastic with air-filled sponson***



Miniguns like these are usually found only on helicopters or armored vehicles. But small special operations river gunboats need heavy firepower to survive close-quarters combat.

slung these gunboats to lift them over dams, making possible an extra element of surprise.

Although the boat's twin waterjets and 440-hp Yanmar diesel engines give it a hefty power-to-weight ratio, its speed and tight turn radius are facilitated by the hull design. The slope of the SOC-R's V-shape belly essentially allows the boat to skate along the surface, with relatively little drag on the hull. There is no hanging rudder or propeller blades to snag on submerged roots and rocks.

The guns, however, are the SOC-R's central attraction. Although tanks and light armored vehicles might have a more powerful cannon, there's arguably more firepower per square inch here than on any other military vehicle.

The two forward weapon mounts of the boat I'm in are fit-

ted with GAU-17/A miniguns. The electrically powered rotating barrels allow for bursts of up to 6000 rounds per minute. (Shooting at that rate through a single barrel could melt the weapon.) M240B light machine guns are fitted into the mid-mounts. Finally, the boat has an aft-mounted .50 cal that has the slowest output but the biggest punch—enough to penetrate light vehicle armor and most building materials. This weapon's position is vital: It can cover the boat crews as they escape from an overwhelming threat.

HEAVY FIRE ON MUDDY WATER

We've just simulated a "hot extract," with the boat pushed up against a bank long enough for nonexistent passengers to scramble onboard. Other SOC-R teams provide covering fire—again, their targets disintegrate before I even have a chance to notice them. Chewing up entire swaths of riverfront property is a prelude to the getaway—our minifleet of SOC-Rs is on the run from the exfiltration site, .50 cal thumping away. "Sometimes on our special op missions, we just run away and come back and fight another day," says Commodore Evin Thompson, former head of Naval Special Warfare Group 4, which runs the SWCCs.

With a series of bangs, a wall of smoke suddenly fills the river behind us. This is another trick the SOC-R crews can employ as they exit a fight—firing smoke canisters from four rear-facing launchers. "What's interesting about the riverine environment is that if you get in trouble, you can either go up the river or down the river, not left or right," Thompson says. On the way back, the flotilla pauses for an all-out exhibition—all four boats decimate a broad stretch of riverbank. Red tracer rounds streak through the dust kicked up by preceding shots, some of which chop lines along the water's surface. With all boats firing, there are at least 12,000 rounds a minute coming at that bank.

With this part of the exercise over, most of the SWCCs head back to their trailer house for a break, but one boat gets the job of helping us with a photo op. The SOC-R speeds past a few times as we watch from the river bank, showing off how quickly it can come to a full stop. The crew's last trick is a high-speed reverse: Everyone on board is cheering as the nimble craft whips its aft around 180 degrees, throwing one SWCC off balance. He manages to hold on before hitting the water, and his crewmates quickly pull him back. When we make it back to land, Mike is eager—and amused—to see the footage; he was the one who almost went overboard.

After ditching me and our photographer, the troop is getting ready to go out again. The sun has already slipped behind the tree line, but the crews still face a long session of overwhelming-firepower training ahead. Once it's dark, they will run maneuvers, firing thousands more live rounds while wearing night-vision goggles.

After nearly 4 hours of daylight operations, the plan is to spend 8 to 12 more hours on the river. This is part of the final stretch of training before Mike's group of roughly 50 SWCCs deploys to Iraq—by early spring, they may already be there. He wishes *me* luck as we part, and walks back toward the boats.

PM

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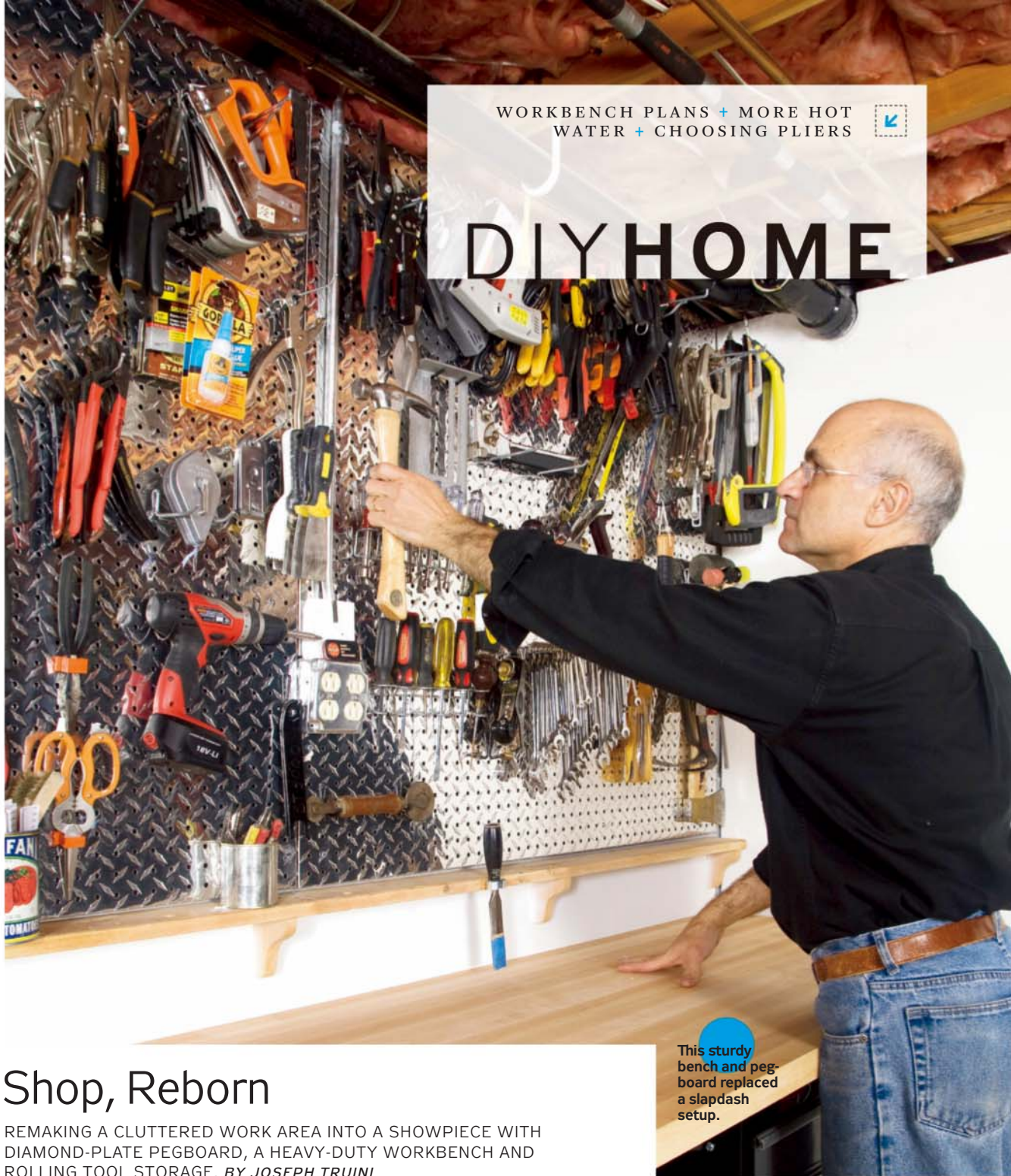
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DIY HOME



Shop, Reborn

REMAKING A CLUTTERED WORK AREA INTO A SHOWPIECE WITH DIAMOND-PLATE PEGBOARD, A HEAVY-DUTY WORKBENCH AND ROLLING TOOL STORAGE. *BY JOSEPH TRUINI*

When I first set up my basement workshop nearly 15 years ago, I didn't have much time or money to invest, so I just banged together a 2 x 4-and-plywood workbench and mounted a sheet of perforated pegboard to the wall.

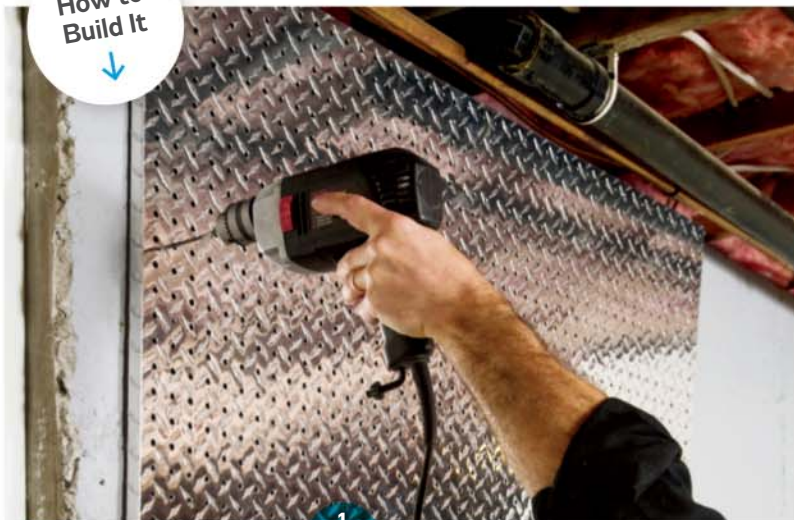
This rudimentary layout served me well over the years. The work-

bench provided a large surface on which to build projects and fix furniture, and the pegboard kept dozens of hand tools neatly organized and readily accessible.

Eventually, though, the system became overloaded. The workbench got buried under an impenetrable pile of old tools, half-done projects

and stacks of lumber. The pegboard ran out of space for any more hooks, and it strained under the weight of my ever-growing tool collection. It was clear that my shop needed a facelift. But rather than just tidying up the tools and clearing off the workbench, I decided to strip the entire space down to the bare floor

This sturdy bench and pegboard replaced a slapdash setup.

How to
Build It

1

The pegboard forms its own guide for boring into the substrate. Simply drill through peg holes to fasten the board. Use a carbide-tip masonry bit and hammer drill to bore into concrete block or solid concrete. Use an ordinary wood-boring bit and drywall screws to attach to drywall and wood framing.



2

A PegBoard X2 panel is tray-shaped. It has a cavity behind it to allow space for the hooked tool holders that fit through the peg holes. To ensure a consistent cavity behind each panel, it comes with a package of peel-and-stick spacers that should be attached to the panel's back before it's installed.



3

With pilot holes bored and spacers installed, drive attachment screws into the substrate. Use masonry screws such as Tapcons to install the panels to concrete block or solid concrete. Use drywall screws for drywall and wood framing.

Cut the pegboard around any surface-mounted electrical boxes. If you're installing the pegboard over existing surface-mounted electrical boxes, switches or plastic-covered cable, replace them with metal conduit and boxes. Conduit and metal boxes provide maximum protection to electrical wiring and devices located in work areas.

4



and walls and start from scratch.

My primary goal was to create a better-organized work space, but I also wanted it to look great. So I built it out of materials not ordinarily found in a home shop, including fat black iron pipe, rock-hard maple butcher block and polished aluminum diamond-plate pegboard. I couldn't be happier with the results.

Installing the Pegboard

At first glance, it may seem that commercial-quality diamond-plate pegboard is just too extravagant for residential use. Maybe. But my old pegboard sagged, and hooks came loose as the holes elongated. The diamond plate will easily stand up to the rigors of an active workshop. Besides, it's just plain cool—an important performance characteristic in my book.

True, this stuff is several times more expensive than the pegboard I replaced, but it's about in line with other top-quality building materials. I paid \$135, plus shipping, for two panels that measure 45½ in. on each side (diamondlifegear.com).

I was able to install the pegboard in minutes. In my case, the panels needed to be fastened to a concrete-block wall, but studs would work just as well. I used a hammer drill and a ⅝-in. carbide-tip masonry drill to bore the required holes through the panel and into the masonry (1). The panels come with small peel-and-stick plastic spacers that maintain the proper distance from the wall in order for the homeowner to insert hooks (2).

With mounting holes bored and spacers applied, all that remained was to drive the fasteners home. I used ⅜ x 2¼-in. Tapcon masonry screws and turned them in with an ordinary cordless drill driver (3)—no heavy equipment necessary. If you've never used these unique fasteners, you owe it to yourself to try them (tapcon.com). They can even be removed and repositioned easily.

About the only tricky thing that you may have to do is cut the pegboard to fit around outlet boxes (4). I used a jigsaw and a high-speed steel blade with teeth shaped to cut aluminum. The simplest way to make these

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5 After pipe and fittings are painted, spin the parts together by hand, and then tighten them up with a pair of pipe wrenches turned in opposite directions.



6 Use floor flanges on the threaded vertical sections of the leg assembly to form the foot at the base and the attachment point for the bench top. Turn the flange onto the vertical sections, stopping only once the threaded portion of pipe is fully engaged in the flange and is snug.



7 The H-shaped leg assembly is fastened to the bench top by driving screws through the attachment holes in the rim of the floor flange. Use a $\frac{5}{32}$ -in. bit and bore 1-in.-deep pilot holes into the top. Then drive in $1\frac{1}{4}$ -in. No. 12 wood screws.



8 A fir plywood backsplash/tool shelf improves the usefulness of the bench. This is nothing more than an L-shaped assembly with decorative sawn brackets. Once the shelf is assembled, bore $\frac{5}{32}$ -in.-dia pilot holes through it and into the bench top. Next, fasten the shelf to the top with $1\frac{1}{2}$ -in. drywall screws.

The crowning touch of the new work area is serious tool storage. Two rolling Craftsman tool chests (model 59299) are stationed beneath the bench; each has a 600-pound capacity.



openings is to saw a U shape and then cut out the corners.

Building the Workbench

I like the old-fashioned, robust look of $1\frac{1}{2}$ -in. threaded steel pipe. Years ago, you had to cut and thread such pipe yourself, but these days, local home centers will do the work for you. That made it an easy material for building the legs of my workbench—one that gave me both a solid frame and a distinctive look.

Working with precut threaded pipe is very simple and convenient. I put together two assemblies, each one shaped like an H and made of five straight lengths joined by a pair of T fittings. Four floor flanges are threaded onto the top and bottom of the vertical legs of each H. Each flange is nothing more than a disc of metal with a large threaded hole in its center and smaller unthreaded holes drilled through its circumference.

To dress up the pipe, I individually spray-painted each part with a glossy black paint that has a hammered texture. Before applying the paint, I wiped down the steel with a clean rag moistened with mineral spirits and covered the threads with masking tape. Keeping the threads bare of paint enabled me to turn the vertical parts of the H in and out during the assembly, so I could fine-tune the components and make sure everything was the same height—an especially important consideration on a wavy concrete basement floor.

From there, I simply had to remove the tape, turn the pieces together by hand and snug them up with a pair of pipe wrenches (5). Then I spun on each floor flange (6). To install the leg assembly, I flipped the top over and used a drill driver to bore pilot holes and drive hefty wood screws through the flange holes and into the top (7). A word of advice if you do this project: Don't undersize the pilot holes. The laminated maple top is very tough, and it doesn't take screws easily. Once the top was installed, I built the tool-hanging backsplash/shelf and screwed it to the top's back edge (8). When everything was done, I rolled two Craftsman tool cabinets into place (9) and put my tools away—in their sleek new home. **PM**



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Homeowners Clinic

by Roy Berendsohn

Q + A

Getting
More
Hot
Water

Q We never seem to have enough hot water. It's not a very big house, so it's not like the water is cooling off on its way to the faucets. Also, we have a reasonably new gas-fired water heater in the basement. I don't understand it, really. I'm considering installing an instantaneous water heater or other equipment to improve this. What are my options?

A You have lots of options, but before you call a plumber, take a few energy-conserving steps. First, flush the water heater. That will remove any sediment that's interfering with heat transfer from the flame to the water above. Next, insulate pipes carrying the heated water to fixtures. Finally, insulate the hot-water tank itself—just be sure not to install insulation over the vent or thermostat. Finally, remove the burner-chamber access cover and, with the light out, inspect the flame while the heater is firing. The flame should be compact and blue. If it's yellow or oddly shaped, the burner may need to be cleaned.

If these simple steps don't substantially reduce the problem, it may be time to upgrade how you produce hot water. Yes, that may include installing an electric or gas instantaneous water heater, but that's a mechanically complex solution, since it requires additional plumbing and fuel connections. And if you opt for the electric water heater, it may also require a dedicated electrical circuit.

It would probably make more sense to go with a larger conventional water heater, since the gas, plumbing and vent connections for the existing heater are already in place. Look for an appliance with a large tank (50 gal) that's insulated with as high an R-value as possible (ideally, R-25).

Additionally, the heater's recovery rate should also be as high as possible. This is the rate at which the water heater can raise the temperature of the inlet water by 90 F. It's expressed in gallons per hour (gph). Typical 50-gal water heaters have recovery rates in the range of 40 gph, but there are heavy-duty models that go as high as 50 to 60 gph. A few companies, such as Bock Water Heaters, even offer residential products with powerful burners that enable recovery rates as high as 109 to 170 gph. That's typically what you would expect from a small commercial water heater.

Cleaning Concrete

My 5-year-old concrete driveway has black stains. What are they and how do I remove them? I've tried bleach and concrete cleaners, to no avail.

The stains probably come from tannins, which are present in oak leaves, acorns and the nuts of other trees, such as hickory. These are some of the most common stains on exterior concrete—and some of the hardest to remove.

First, make a mild solution of wood bleach (oxalic acid crystals) dissolved in water. Try an inconspicuous area first. Apply it to the stains, scrub and rinse. That might do the trick. If not, either pressure wash the concrete using a nozzle that produces a broad fan-shaped spray pattern or use a rental rotary floor scrubber and a brush designed for concrete and uneven surfaces. No matter what method you use, go easy. Overly aggressive cleaning can remove the protective top layer of concrete. This exposes a

PHOTOGRAPH BY ALAMY

comparatively weak lower layer that is far more prone to damage from rain, sun and freeze-thaw cycles.

Roof Framing

I'm building a free-standing garage, and I'm wondering if it needs a ridgeboard. I've looked at some old garages, sheds and outbuildings, and I've noticed that many did not have ridgeboards, while others used just a piece of tongue-and-groove siding or sheathing. Is a ridge needed?

Most stick-framed roofs (those not framed with trusses, in other words) have a ridge, a horizontal piece of lumber at the apex of the roof where the rafter peaks are fastened. There are exceptions, especially among sheds and other small structures. The carpenters who threw up many of those old buildings were reluctant to use any more lumber than was absolutely necessary. In fact, despite their reputation for solid construction, many older houses are so scantily built it's a wonder they've stood as long as they have.

So, let me put it this way: A little more lumber is always better than a little less lumber. While a ridgeboard can be omitted or minimized in down-

and-dirty construction, you can't go wrong by installing one. It will keep the ridgeline from sagging in the future. And it will simplify construction by providing a sturdy connection point at the peak of the roof. Besides, unless you frame the garage with roof trusses, the town will almost certainly require a ridgeboard to grant the building permit.

For a truly sturdy roof, use a ridge that is at least as wide as (and preferably wider than) the end cut of the rafter that meets it. A simple way to ensure this in most cases is to use a ridge that's one lumber size wider than the rafter that meets it. If you're using 2 x 6 rafters, for example, use a 2 x 8 ridge.

Not-So-Royal Flush

My toilet flushes poorly. How do I correct that?

There are several things you can do. First, see whether the tank is filling with water adequately. Lift the tank lid and check that the water is up to the fill line. If it's not, a new fill-valve assembly or adjustments to the old one are in order.

Next, be sure that the waterjet holes on the bottom of the bowl's rim are clear. Use a small mirror to check this. Clear the holes with a stub of wire

Using Wood Filler

I'm preparing to do some exterior fix-up work this spring and plan to touch up some rotted exterior wood with two-part epoxy wood filler. I like the way the product looks after it's smoothed, but I hate using it because it's so much harder than wood. It takes forever to sand down. Is there a filler that's easier to use but still stands up to outdoor use?



Stick with the filler you're using, but don't wait until it's fully cured to start work on it. First, dig out rotted wood with a beat-up chisel. Next, goop the filler generously onto the repair area. The filler hardens quickly, so without waiting very long, take a razor-sharp chisel (not the one you used to dig out the rot) and pare away excess filler before it hardens.

You'll be amazed. The stuff will come off the surface in nice big curls that have the consistency of hard chocolate. Repeat with another layer if necessary. After two or three applications, you should have a surface that's pretty close to what you need. Sand the remaining filler smooth, prime the entire surface and paint with a semigloss or gloss exterior paint.

■ PROBLEM SOLVED

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The \$240 Laing Autocirc, for example, mounts to the wall under a sink. The hot-water and cold-water supply lines enter the device and lead up

from it to the faucet. When the device's thermostat activates the pump, it moves the cooled water in the hot-water supply into the cold-water supply and back to the water heater.

The Autocirc is installed at the sink farthest from the water heater. The only tricky thing is that you have to install an outlet receptacle under the sink.

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if necessary, or simply scrub thoroughly.

Assuming the items above check out, lift the lid and flush the toilet. Watch the flapper valve. It should move up briskly but then settle down gently so that sufficient water moves through to do its job. If the flapper settles down too soon, you'll get an anemic flush. Adjust the flapper's chain so it stays up long enough to allow for proper water movement.

Cutting Down Counters

I'm doing an inexpensive kitchen fix-up and I want to know how to cut a few inches off the post-formed laminate kitchen counter I bought at a home center. It's the kind that has a curving backsplash.

There are a number of ways to cut down a counter. You can tip it upside down and cut through the counter itself and the backsplash with one pass of a circular saw. The blade may not pass entirely through the backsplash, though. You can finish the cut using a crosscut saw. Reduce the likelihood of chipping the laminate by applying a strip of masking tape to it along the cut line. Make sure that the tape is carefully aligned with the cut line that you mark on the counter's back. Obviously, if the saw blade misses the tape, then the tape hasn't done much good. Also, you'll need to support the scrap piece as you make the cut

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because it can tear free and leave a ragged stump.

You can also do a good job using a handsaw. Typical plastic laminate is not as tough as you'd think. A sharp eight-point crosscut saw will slice through a faceup counter pretty readily. I surprised some neighbors once by cutting a counter for them using a perfectly good handsaw that they had downstairs. I think they were expecting a big production. Instead, I had the counter cut in about 5 minutes.

Assuming the cut end faces an

appliance, you don't need to do anything else. If the cut end faces out into the kitchen, fixing the end cut is a bit more tricky. You can glue a piece of plastic laminate on the end and very carefully rout off the excess using a laminate trimmer. There are two downsides, though: You can damage the counter, and it puts a laminate seam across the counter's face—normally the end pieces go on first, then the front edge is applied, then the top. It may be easier to carefully sand and spray paint the cut end.

PM

KNOW YOUR STUFF

Pliers

THE RIGHT TOOL CAN GET A GRIP ON ANY PROJECT



Linesman

Best for: Cutting copper cable.

Details:

The ground-back tip (shown), known as a New England nose, allows reaming inside the cut edges of metal conduits. Variations include versions to pull fish tape and others that chop nails, screws and bolts. Also called side cutters.

Long-Nose

Best for: Cutting copper wire and bending hooks in wires to fit over terminal screws. The tool reaches into tight spots to pull off wire terminal connectors.

Details: Heavy-duty types have the features of linesman pliers, such as high-leverage cutting. Also called needle-nose.

Tongue-and-Groove

Best for: Gripping pipe, plumbing fittings and oddly shaped parts, such as broken bolts.

Details: Invented by Channellock in 1933, these pliers also work as blacksmith tongs or for holding a cold chisel as it's struck with a hammer. Also called water-pump pliers.

Diagonal Cutters

Best for: Cutting wire in a tight spot.

Details: Some are forged from chrome vanadium steel for extra toughness and corrosion resistance in damp environments. Offset-handle types excel at flush-to-surface cuts. Also called dikes.

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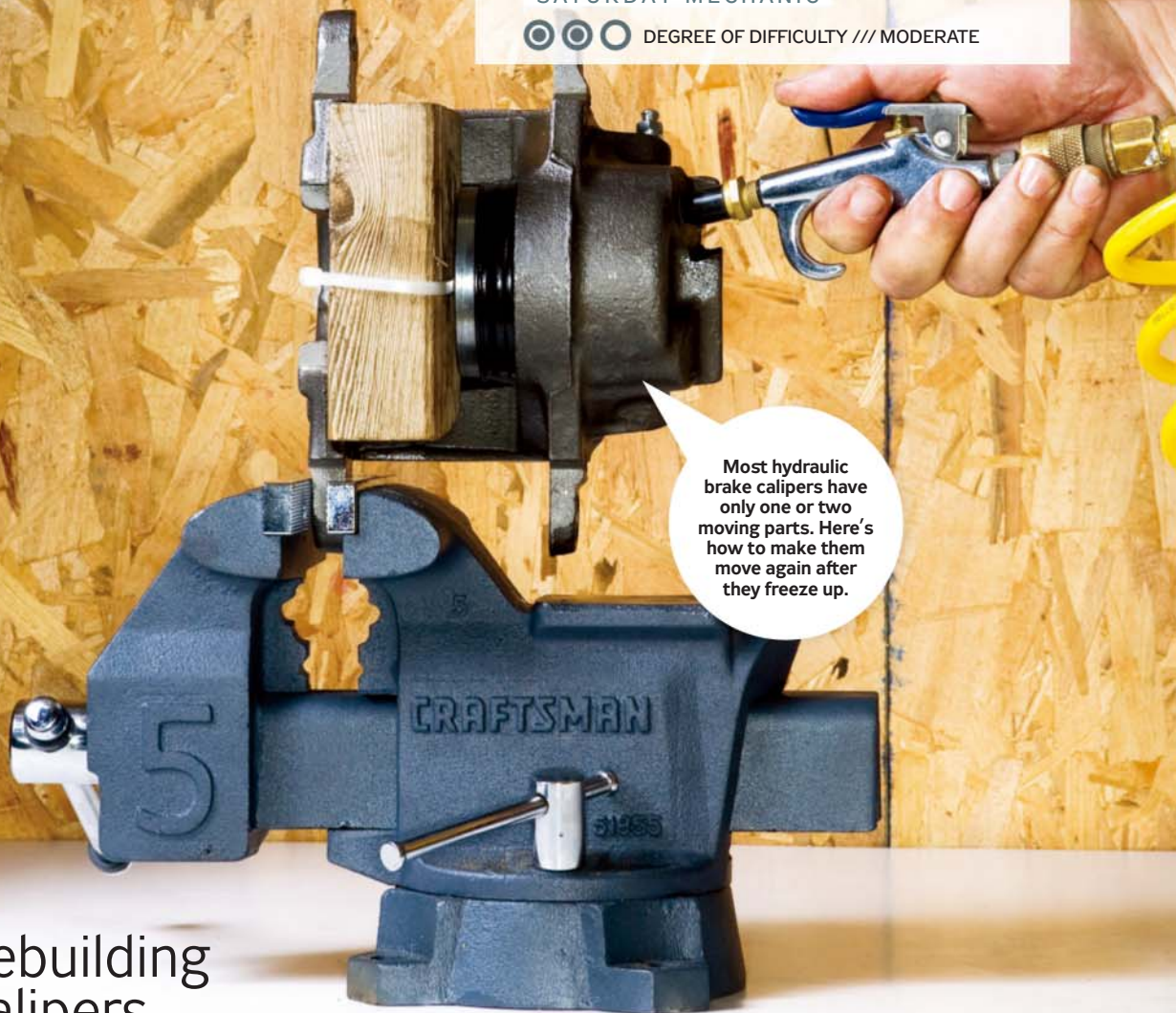


DIY AUTO

SATURDAY MECHANIC



DEGREE OF DIFFICULTY /// MODERATE



Most hydraulic brake calipers have only one or two moving parts. Here's how to make them move again after they freeze up.

Rebuilding Calipers

REBUILDING A DIFFICULT-TO-FIND BRAKE CALIPER MIGHT BE YOUR ONLY SOLUTION TO GETTING THAT CLASSIC CAR OUT ON THE ROAD AGAIN. *BY MIKE ALLEN*

It's a beautiful spring day, and a perfect time to break the winter seal on the garage and drive around in your classic Corvette, vintage motorcycle or whatever pride and joy you happen to have stashed inside. Off with the cover, and the engine turns over willingly, thank goodness.

A quick warmup and you're off for a loop around town.

All of which is fine, until the engine seems a little ... reluctant to maintain speed. As you turn a corner, you catch that unmistakable whiff of burning sweat socks—you've got a dragging brake caliper. Sure enough, one of the

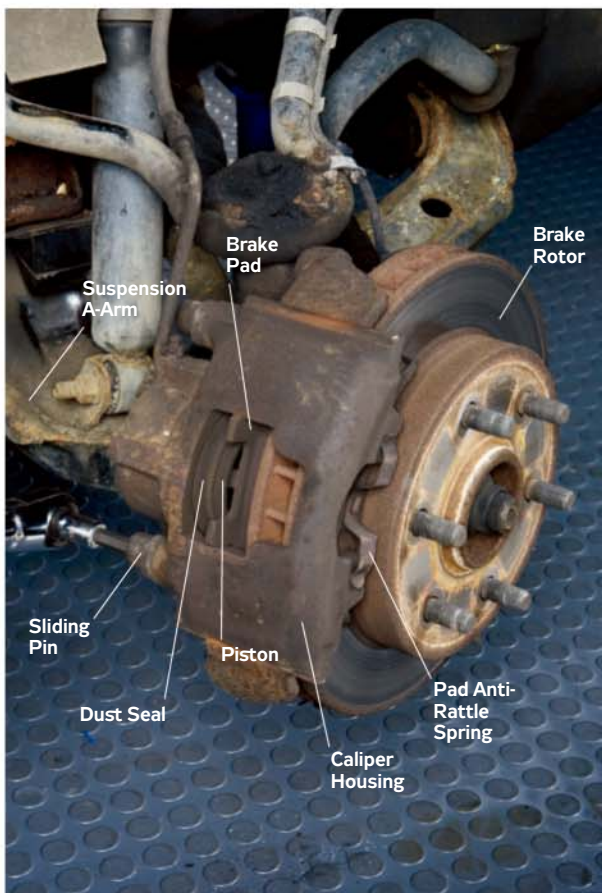
front wheels is too hot to touch. You limp the few blocks home at low speed. Now your Saturday morning drive has just mutated from a fun-filled jaunt into an afternoon's worth of work chasing down a replacement caliper. A quick trip to the auto parts store, followed by a round of phone calls to dealerships and stores within an increasingly large radius turns up nothing. You'll have to rebuild the caliper yourself.

Most brake calipers that fail get replaced with either a new part or a rebuilt one. Indeed, we picked up a rebuilt caliper for this story at the local NAPA store. Industry-wide, it's common practice to return used calipers to a central rebuilding station where the caliper assembly is rebuilt. It will be stripped to the basic casting, cleaned of all vestiges of road grime by automated equipment, and glass-bead-

blasted or shot-peened to remove any and all corrosion and rust. After a quick inspection, it's reassembled with a new piston, seal and bleeder bolt. Inside the box with the like-new caliper assembly, you'll find fresh sliding pins and any other hardware that should be replaced—and sometimes, new pads as well. All you need to do is install the caliper, bleed it, and you're back on the road in a few minutes. Often, the modest price of this rebuilt assembly is less than the over-the-counter price of the aggregate parts you'd have to buy separately to rebuild the unit yourself. No wonder pro mechanics rarely bother to rebuild calipers anymore.

But you've gotten the bad news from at least a half-dozen countermeasures in the last hour—no rebuilt, or even new, calipers until the middle of next week. And that scotches your plan for

Start by removing the caliper assembly from the steering upright. Break all the bolts loose, including the bleeder, before removing the brake line. And don't forget to wear a particle mask.



Use some non-scratching tool, like a popsicle stick or this nylon cable tie, to pry the seal loose from its groove.



traveling to tomorrow afternoon's car show. One savvy counterman, an old-school guy, has a suggestion: He knows that the cylinder bore on your caliper is common to several other cars. And he does have generic brake piston seals in your size. You rush over to his store and pick up a set of seals and a couple of pints of fresh brake fluid. Price: less than your lunch at the fast-food drive-through window.

One caveat: If your frozen caliper is a rear caliper, with attendant parking-brake cables and internal antipush-back hardware, you'll need to consult the service manual for rebuild advice. Also, take note that we're talking about calipers here. If your rotors are out of true, worn too thin or scored by the dragging pads, you'll need to remove and machine or replace them as well. Your brake system is not a good place to cut corners. Okay, I'm off my safety soapbox. You may now return to your regularly scheduled Saturday Mechanic.

Brake It Down

First loosen the lug nuts, block the rear wheels and get the car up on jackstands. Here's your chance to break all of the caliper bolts loose while that caliper is still mounted to something solid. Judicious tapping and some penetrating oil should help break the bleeder bolt loose. Use a flare-nut wrench on the bleeder—it's less likely to round off the small, hollow bolt.

Odds are, if the rubber flex line screws directly into the caliper casting,

you may need to remove the rubber brake line at the far end first. Ditto when using a flare-nut wrench on the brake line. Consider replacing the steel or rubber brake lines if they are older than your dog.

On the Bench

Strip the caliper of the pads, shims, springs and sliders or pins. Remove the outer dust seal, too. Now you need to remove the piston—but you'll quickly realize there's no way to grab it. Get a piece of wood slightly thicker than both brake pads stacked together. Put that wood in the caliper aft of the piston, and add low-pressure compressed air to the inlet port. Pop! Your piston is out. And so is your little finger if you're not paying attention. The same goes for your corneas if you don't cover the whole deal with a shop towel to contain the flying brake fluid. If the piston is stuck—which is how we got into this mess—the process may take a little more time and pressure. If your caliper has more than one piston, use more wood, clamps or whatever to release one at a time.

Inspect the piston. Rebuild kits usually include a new piston, but if you're gleaning from generic parts, you may be stuck, literally. Minor surface blemishes can be polished out with wet 2000-grit sandpaper, but any pits in



We sawed this GM caliper in half so you could see inside—this shows evidence of serious corrosion pitting in the base of the bore. We cleaned it with 600-grit paper.

the metal means replacement will be necessary. I've had replacement pistons machined out of stainless-steel bar stock for oddball cars.

To get the O-ring free, use something that won't damage the caliper bore. Odds are, corrosion built up between the piston and bore is what made things stick. Unlike surface damage to the piston, minor pitting of the bore is no big deal—the square-cut O-ring seals between its recessed groove and the piston, not to the outer bore. Clean up the bore surface with wet 600-grit wet-or-dry paper, then thoroughly clean the entire caliper of all dirt, rust, abrasives and old brake fluid with hot, soapy water. Some two-piston calipers may have internal rubber seals—so no hydrocarbon solvents, please.

All clean and dry? Lubricate the piston with clean brake fluid and slide it

into the bore. Once the piston is squared up, it should slide in all the way with moderate finger pressure. If not, find out why. Remove the piston again, install the new seal, lubricate again with fresh fluid and push it on home. Add the outer dust boot, and reinstall the freshly rebuilt caliper. Repeat on the other side. Don't be lazy and rebuild or replace only one side. Brakes should always be maintained as an axle set, not one corner at a time. Top off the reservoir with fresh fluid, and bleed the system (see "Bleeding Your Brakes," April '07).

Brake Pad Tech

Not all brake pads are created equal. There's a choice today of various friction materials used in pads to do the work of actually stopping your car. Asbestos used to be a major component of brake pads, but OSHA regulations now make this carcinogen scarce. Organic materials such as Kevlar, often found in OEM brake applications, represent a compromise of pad life, braking aggressiveness, dusty wheels and noise. If you're interested in a longer-lasting pad material, look into a premium metallic or ceramic lining. These materials can sometimes squeal or hiss, wear out the discs faster and cover the front wheels with ugly dust. Performance cars, like that Corvette of yours, might stop better with metallic pads. The downside is that those polished rims—aside from the cost—will be covered in gray dust after a day's drive.

PM

Once everything is clean, put it all back together. Be sure to tidy up or replace any sliding pins or raceways so the caliper can move back and forth as the pads wear.



Car Clinic

by Mike Allen

Q + A



A Low Blow

Q I'm trying to resurrect a classic Datsun sedan that's been sitting in my garage for years. Hey, it gets better mileage than my pickup. The compression on all cylinders is only around 110 pounds. Why is it so low?

A It could just be that the cylinder walls are rusty and the rings aren't sealing well—but in that case I'd expect more cylinder-to-cylinder variation. Odds are, all four aren't rusting equally, because the pistons couldn't have all stopped the same distance up the cylinder wall when the engine was shut down years ago. There's generally no rust where a piston has held oil next to

A compression test can be very diagnostic, but only if done properly.

the iron liner, but plenty of rust above or below. A pitted, rusty surface doesn't seal as well as one in good condition, although some rusty surfaces will clean up a little if you run the engine for a while.

I think you need to redo that compression test in a few days, because I suspect it wasn't done properly. Start by warming up the engine, but not so hot that you burn yourself while removing the plugs—all of them. The compression numbers are heavily influenced by how fast the engine spins during testing, and removing the plugs will reduce drag. Be sure the battery is fully charged and in good enough

Don't Say I Didn't Warn You

I tried to replace the spark plugs on my 2006 F-150. They were so tight that a couple of them broke off in the cylinder head. Now what?

Patience, Grasshopper.

I've been warning people recently that leaving new-style precious-metal spark plugs in place for their normal 100K service life will marry them to the soft aluminum cylinder head, resulting in stripped threads when it's time to replace them. Technical



Service Bulletin (TSB) No. 08-7-6 requires a special procedure to get the job done. Soak the plug with carb cleaner for a few minutes after cracking the threads loose. This will allow some of the carbon that has built up between the plug's ground shield and the cylinder head to dissolve. Next, work the plug out with a back-and-forth rotation to clear the carbon. The TSB then details an elaborate procedure to remove the parts of the plug that are left behind. Options are: Find a Ford mechanic who will either attempt this procedure or remove the cylinder head. The TSB ends by suggesting a smear of antiseize compound on the area to prevent this from recurring.

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shape to deliver a full current to the starter motor. If the battery is low, the engine won't spin fast enough to get a good reading.

The most common mistake people make when doing a compression test is not opening the throttle fully while cranking the engine. A closed throttle will leave a vacuum in the intake, lowering the reading. In fact, even low barometric pressure will affect it. I prefer the screw-in-style compression gauge to the type that just seals with a rubber stopper. Crank the engine over for six full pulses to be sure you're getting the highest reading.

Still low? Try spraying a teaspoon-

ful of engine oil in each cylinder immediately before doing a second compression test: If the reading improves much, you've got bad rings.

Corrosive Question

I have a 2002 Chevy Impala whose fuel gauge failed after 50,000 miles. I used an additive to the gas to clean the corroded contact points on the gauge. This may have helped clean the fuel pump, but it did nothing for the gauge. The only fix someone suggested to me was to install a new fuel pump and gauge unit. And that costs more than \$400. What is the cause of this

problem—and do ethanol additives in gas contribute to it?

Alcohol, in concentrations as high as 10 percent, is used to reduce carbon monoxide emissions because the alcohol molecule contains oxygen, something missing in the petrochemical soup we call gasoline. Alcohol is corrosive, and I'm seeing a lot of complaints about failing fuel-gauge senders. Don't blame the petroleum companies—alcohol percentages are mandated by the EPA. Biodegradable ethanol is used instead of MTBE and ETBE, since these harmful chemicals were found in groundwater, almost certainly from leaking underground storage tanks. Flex-fuel cars, rated to run on mixtures of ethanol as high as 85 percent, have more alcohol-tolerant parts in the fuel system.

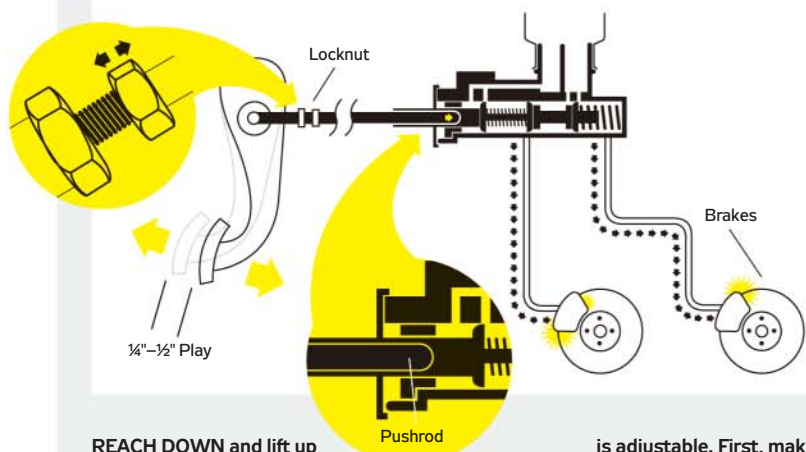
Now, about your problem: The fuel-gauge sender is a simple rheostat with metal contacts that slide along a resistor as the float goes up and down. Gauges fail when these contacts start to get dirty and corroded. It's a simple procedure to clean or replace this unit—which is indeed available without buying a new pump. Problem is, the whole business is located inside the fuel tank, which has to be drained and removed. It's not a simple task if you don't have a lift or a floor jack and stands. It's potentially dangerous too. That makes the labor to have this done a significant issue. But \$400 to replace the pump-sender assembly is a decent price. You could yank the tank yourself if you feel up to it and try cleaning the contacts with some 400-grit wet-or-dry sandpaper and electrical contact cleaner.

The cheapest solution is a 30-cent grease pencil to write the mileage of the last fill-up on the windshield.

■ THE MECHANIC'S HEADS UP

An Uplifting Experience

FINE-TUNE YOUR BRAKE-PEDAL PLAY FOR PROPER FEEL AND PERFORMANCE.



REACH DOWN and lift up the brake pedal with your fingers. There should be approximately ¼ to ½ in. of free play before it hits the upper stop. Is there more or less movement than that? Several things can go wrong here: If the pedal pivot gets sticky and doesn't allow the pedal itself to return freely, or if you've replaced the master cylinder and the amount of pedal free-play is too small, the master-cylinder

piston will never return to its fully extended position. That, in turn, will trap brake fluid in the master cylinder—which will prevent the pistons in the brake calipers or drums from returning, and your brakes will drag. Too much play will give you a low, spongy pedal. Fortunately, the pushrod between the brake pedal and the master cylinder

is adjustable. First, make sure the brake pedal pivot is moving freely—I've seen rust and disintegrated bushings freeze this joint. Same for the clevis on the pushrod. All you need to do now is to loosen the jam nut and shorten or lengthen the pushrod by turning it until there's enough clearance. A small amount of clearance at the clevis should translate to about a quarter-inch at the pedal. —M.A.

Sign of the Times

I recently purchased crossbars for my 2008 Toyota Highlander's roof rack. The instructions on removing the rear caps were very ambiguous. I attempted to remove these end caps, but it appeared that I was going to destroy these flimsy plastic pieces. Any assistance would be greatly appreciated.

I read the instructions too: You're right—not very helpful. Maybe the instructions in the box with the rack parts was dif-

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ferent, but the shop manual page I got from AllData specifically said these plastic trim pieces are fragile and may need to be replaced after they're removed. This is not the level of quality I've come

to expect from Toyota.

More generically, interior and exterior trim pieces seem to be getting more and more fragile, and they are more and more often snap-in parts rather

than those attached with a screw or bolt. It makes life simple on the production line, I guess, but for those of us who may need to remove these pieces several times over the life span of the car, it's frustrating. Dismantling an interior or front fascia today is like playing pick-up sticks. Hello, automakers? Can't trim pieces be made more robust again—like in the old days?



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Solved Simply

I have a 1993 Chrysler Fifth Avenue with around 120,000 miles on the ticker. Every time I start the car and press the brake to put it into drive or reverse, the ABS light comes on for a few seconds and I can hear the ABS pump. Also, the ABS light comes on occasionally when I press hard on the brakes. When that happens, I still hear the pump. The brakes are fine otherwise.

Every time any car with ABS is started, the ABS computer goes through a power-on self-test: The first time the brake pedal is depressed, the hydraulic pump and solenoid valves in the ABS control unit cycle briefly. So yours sounds like it's working as designed. And if you press the brake pedal firmly enough, the ABS system will kick in and prevent the wheels from locking up. When that happens, the ABS light on the dash comes on and the pump motor runs briefly. So this also sounds like it's working as designed.

Unless these symptoms have just cropped up, there's no problem.

Under Pressure

In your column that appeared in the Oct. 19, 2008, edition of *The Boston Globe*, you say, "It's impossible to see



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if your tires are underinflated without a tire-pressure gauge." I don't believe this statement is entirely accurate. I just purchased a 2008 Subaru Tribeca with a tire-pressure monitoring system (TPMS). In cooler temperatures, the pressure in the tires has gone down, and the monitoring system alerted me to this fact (the tire was about 5 or 6 pounds below its required pressure). I admit the system doesn't provide actual pressure readouts, but it's a good safety check. Don't you agree?

All cars and light trucks sold in the U.S. since 2007 have a TPMS, as mandated by the Department of Transportation (DOT). And I predict that these systems will have little effect on how poorly the American driving public maintains its tire pressures. Just the opposite: consumers, being the lazy dolts they are, will assume their tire pressures are fine because the TIRE PRESSURE warning light on the dash isn't lit.

There are two types of systems. The best—and more expensive—uses a radio transponder mounted inside the tire. With this type, you can usually call up the individual tire pressures on a dashboard display.

The second uses data from the ABS/traction-control system. An underinflated tire will have a rolling radius smaller than the other three, and consequently will rotate faster than the others. When the difference in rotation becomes extreme enough, the low-pressure alarm goes off. There are several problems with this. If the outside air temp goes from very hot to very cold, all four tires will lose pressure equally, and the alarm won't sound.

There's an even bigger issue, as far as I'm concerned: Neither type of monitoring system sets off the warning indicator until, as you've discovered, the pressure is 5 or 6 pounds too low—the spec required by law is 25 percent below the recommended pressure.

And that's just plain too low. It's low enough to accelerate tire wear and raise rolling resistance to the point where it affects fuel economy.

More important, it's low enough to affect handling and braking, especially in rainy or snowy conditions.

Any driver who relies on the TPMS to tell him he needs air is going to spend a lot of miles driving on dangerously underinflated tires. The DOT dropped the ball when they set the permissible amount of underinflation. There's still no substitute for a \$10 tire gauge in your glove box.

False Positive

I have a 1994 Jeep Cherokee Sport. The brakes have been bled multiple times and I still get sponginess in the pedal. The front disc brakes work, but the rear brakes never seem to get up to pressure. When the vehicle is up on blocks, the front wheels stop if the brakes are applied, but the rears keep turning. I have replaced the rear cylinders and the master cylinder. What's going on here?

The sponginess is probably air in the system—if you have ABS, the manual calls for a conventional bleed, followed by a bleed with the Chrysler scan tool to cycle the pump and solenoids in the ABS controller, followed by a second conventional bleed.

Sound like a lot of work? I've gotten good at working on brake systems without ever introducing any air into the system—it's still possible to successfully flush the system with fresh fluid without hooking it up to the tricorder.

As far as the ineffectiveness of the rear brakes: If you have the rear suspension at full droop with the frame up on stands, the load compensation valve will interpret that as a lightly loaded rear suspension and reduce the brake pressure to the rears to nearly nothing. I bet the situation will be different if you put the stands underneath the axle instead of the frame rail. Give that a try and let me know how it works out. **PM**

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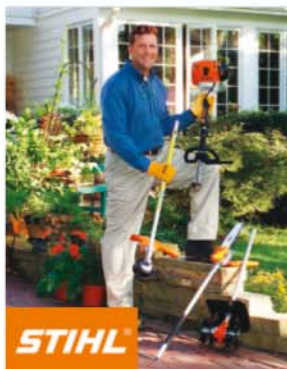
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DIY TECH

Make Your PC Boot Faster

THERE'S NO NEED TO SUFFER THROUGH SLOW STARTUPS. PM'S SPECIAL REGIMEN OF OS TWEAKS AND SOFTWARE SURGERY CAN SPEED THINGS UP. BY ERIN SCOTTBERG



Why can't a computer be more like a television? When you push the power button on a TV, it just turns on. Computers, on the other hand, boot—as in, they take so long to get started that you want to stick your boot into them.

You would think that the march of technological progress would have reduced boot times over the years,

but newer operating systems can take longer—Microsoft Vista actually tends to boot more slowly than its predecessor, Windows XP. (Microsoft claims its next-generation operating system, Windows 7, should provide drastic improvements in boot time.)

Additionally, boot times increase with a computer's age. As you use your PC and more programs and

devices are installed, the startup process gets even longer. And these slow boot times can lead to bad behavior. Many users become so frustrated that they leave their computers on constantly, wasting electricity and delaying valuable OS security updates.

But take heart: There are steps you can take to speed things along.

Depending on the configuration of your computer, many of the various system checks and processes that take place during boot-up may be unnecessary or irrelevant to you. A variety of tricks of varying sophistication can reclaim valuable minutes or seconds of get-up-and-go time. We tested expert tactics on three well-used computers in PM's tech lab.

Ditch Dusty Programs

As a general rule, an uncluttered computer is a fast computer. The easiest step to speed startup is to remove software that you no longer use. Many of these seemingly fallow programs are running active background processes that launch every time you push the power button. This doesn't just slow down your startup, it chews up RAM and drags down the overall performance of your PC.

To get a full list of installed software, check Control Panel in Vista and select Remove Programs (in XP go to Add/Remove Programs). If you find programs that you're not using or that support equipment you no longer own, eliminate them.

One of our test computers, a 3-year-old XP machine, had more than two dozen programs that hadn't been used in years. After we removed them, the machine's boot time was reduced from 2 minutes 45 seconds to 2 minutes 21 seconds. Across all three of our computers, the biggest offender was AIM instant-messaging software. Removing it shaved an average of 8 seconds off boot time.

Even brand-new PCs can be junked up with useless applications, known as trialware, that load processes at startup. Since these programs aren't formally installed on your system, they may not show up in your Remove Programs list. That shouldn't stop you from getting rid of them if you have no intention of using the software.

The easiest way to purge unwanted trialware is by using a program called, believe it or not, PC Decrapifier. This free, downloadable tool specifically

targets trial software and puts it on a chopping block for you to eliminate.

On a Dell laptop we analyzed, Decrapifier found several programs imploring users to "Get High Speed Internet!" from service providers angling for new business. Delete!

Reconfigure Pushy Software

Some startup slowdowns come from software that you do use, but don't necessarily need running in your system's background. Many programs have components that load at startup, then monitor your OS constantly. That makes perfect sense for antivirus software that must continually watch for suspicious activity on your PC, but it's probably not necessary to have the software that came with your digital camera always running so that it can instantly offload pictures.

There are a few ways to check which programs are muscling into your startup sequence. In Vista, you can manage startup applications through Windows Defender, Microsoft's built-in program that monitors for spyware, pop-ups and performance drags. Defender has an integrated tool called Software Explorer that lets you



Macs Need Speed, Too

In our tests, Mac OS X natively booted faster than Microsoft Vista, but Macs are susceptible to slow boot times too. And often, it's because of the same problems. "If your Mac is taking a long time to boot, the main culprit is probably startup software," says Ben Casey, a Mac technician at TekServe in New York. "Check for erroneous applications and delete what you don't need launching every time." If you have multiple accounts on one Mac, edit the list of startup programs for individual users by going to the Accounts panel of System Preferences and selecting Login Items. Also, look in the universal startup folder, which controls what loads for all users. (It is called Startup Items, in the Library folder on your hard drive). The shorter these lists, the quicker your machine will start up.

If your computer is still taking too long to boot, try clearing your caches using a free piece of software called Onyx (titanium.free.fr/pgs/english.html). The first boot after purging your caches will take longer than usual, because the computer needs to reconstruct those caches from scratch, but the resulting up-to-date caches will allow for a faster boot time. — E.S.

check programs that load at startup and disable anything unnecessary.

You can also access the list of startup applications in either Vista or XP through the Msconfig utility (type "msconfig" into the Run box in the Start menu). Select the Startup tab, then uncheck any applications you think might be slowing your startup.

Both options allow you to disable a program's startup component without completely removing it. So if you disable something and then discover that it was vital to the operation of your PC, you can always turn it back on.

Inevitably, you'll find programs in your startup configuration that you've never heard of before. To sort it all out, consult an online reference such as Sysinfo. This site categorizes startup entries according to how necessary they are. On one of our test PCs we found avgtray.exe configured as a startup operation. This miniprogram was a part of the AVG antivirus software suite and was designed to launch AVG from an icon in the system tray at the bottom right of the Windows home screen. SysInfo categorized avgtray.exe as "User's Choice," meaning that it's not imperative to the PC's operation but could be useful, so we decided to keep it. Many of the items we found in the startup menus of our test PCs were software that could be started on an as-needed basis, but didn't need to be launched at startup, so we disabled them.

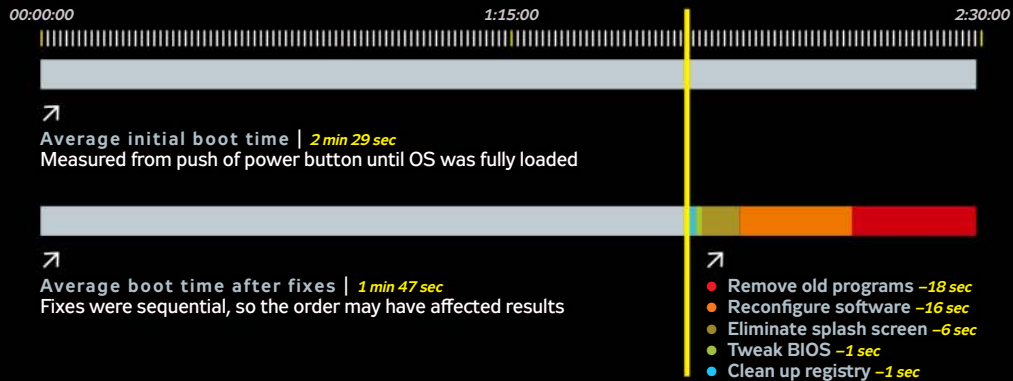
Cut the Splash Screen

If you're serious about shaving every last second of startup time, dip into



PM Boot Test

We took three well-used PCs and ran them through a battery of cleanups and reconfigurations to see how much time we could trim from startup. The result was a 30 percent improvement. —E.S.



the Boot tab in the Msconfig utility, which controls the settings for the boot initialization/configuration file. Generally, users should tread carefully when tinkering with boot.ini, but one easy edit is to check the “/noguiboot” option. This saves time by skipping the Windows startup animation.

Edit Your BIOS

Before the operating system loads up on your computer, software on the motherboard known as the BIOS (Basic Input Output System) governs the configuration of the PC’s hardware. As with the boot.ini file, it’s advisable to tread carefully in the BIOS to avoid disabling something important, but a few well-placed tweaks can save valuable seconds when you boot.

The BIOS sets the boot sequence for your PC and makes sure all the components—like the video card, memory and hard drive—function

together. To get to the BIOS on most computers, you hit one of the function keys (usually F2, F10 or F12; your computer should prompt you on the screen during startup). The BIOS checks each drive attached to your computer for an operating system to boot from, but it doesn’t always check in the most logical order. On one of our test laptops, the BIOS was looking at the USB drive and optical drive before checking the hard drive where the OS is installed. I rearranged the boot order to check the hard drive first.

Most BIOSs scan the computer memory for errors at startup, but if you haven’t made any modifications to your RAM or noticed any errors, this probably can be skipped. If your BIOS has a Quick Boot or Skip Memory Check function, you can save a few extra seconds.

Clean Up the Registry

The registry is a database in both Windows Vista and XP that stores information about your hardware, software preferences and user profiles. Whenever you change something in Windows, it is logged in the registry. But when software is deleted or hardware

is upgraded, the registry isn’t always updated properly, so it can end up full of outdated, useless entries. Unlike the Msconfig utility and BIOS, casual deletions from the registry can cause irreversible damage, so it is no place for an inexperienced computer user to go tinkering on his own. But a good software solution can help clean it out for you. Free programs such as CCleaner and Glary Utilities, as well as more fully featured pay software such as System Mechanic (\$50), are available for download online and will scrub the registry for “keys” left over from old applications no longer resident on your machine. These may be delaying boot time by causing the computer to scan for nonexistent programs during startup. A clean registry makes the whole process more efficient.

How much time you’ll gain overall depends entirely on how messed up your computer was in the first place. Cleaning out all of the digital clutter still won’t make your computer instant-on, but it should make the wait more bearable.

Digital Clinic

by Seth Porges

Q + A

iPod Auto Control?

Q My car doesn't have a built-in iPod dock. What's the best way to play my MP3s while I drive around?

A Buy a new car—just kidding. While some new vehicles have iPod docks, owners of dockless vehicles can patch together a method for streaming their MP3s through the built-in stereo. Effort and expense will vary, and some setups will sound much better than others.

Option 1: Wireless FM Transmitter

INSTALLATION: **Easy**

SOUND QUALITY: **Poor**

+ FM transmitters are the most popular and convenient way of playing an MP3 device through a car stereo. They typically plug into an iPod's dock or headphone jack to create what is essentially a low-wattage pirate radio station—powerful enough to be picked up by your car radio inches away, but not strong enough to interfere with neighboring car radios.

Unfortunately, these transmitters need to compete with real (and far more powerful) radio stations and are easily swamped by 6000 watts of classic rock. When this happens, the sound that comes out of the speakers can be a cacophonous mix of static, local radio stations and whatever your iPod is playing. This problem is exacerbated by FCC regulations, which prohibit FM transmitters from broadcasting at greater than 18.75 nanowatts, essentially ensuring that they won't work

well. And while this problem is particularly pronounced in cities with crowded airwaves, the issue exists nearly everywhere in the country. There's another downside to FM transmitters: Even under ideal conditions, FM radio just can't deliver excellent sound quality.

That being said, FM transmitters are extremely convenient and, with many models selling for as little as \$15, affordable. If you decide to use one, choose a model that lets you pick any FM frequency (some restrict you to a few stations on the top or bottom of the spectrum). This will increase your odds of finding an open channel.

Option 2: Cassette Adapter

INSTALLATION: **Easy**

SOUND QUALITY: **Good**

+ Audio cassette adapters take advantage of an increasingly rare feature: a car's tape player. These adapters are shaped exactly like a cassette tape. They are cheap (around \$15), commonplace and deliver decent sound quality.

To use one, simply plug one end into the MP3 player's headphone jack and the other into the tape deck. If your automobile has a cassette player, there is no easier way to get interference-free listening.

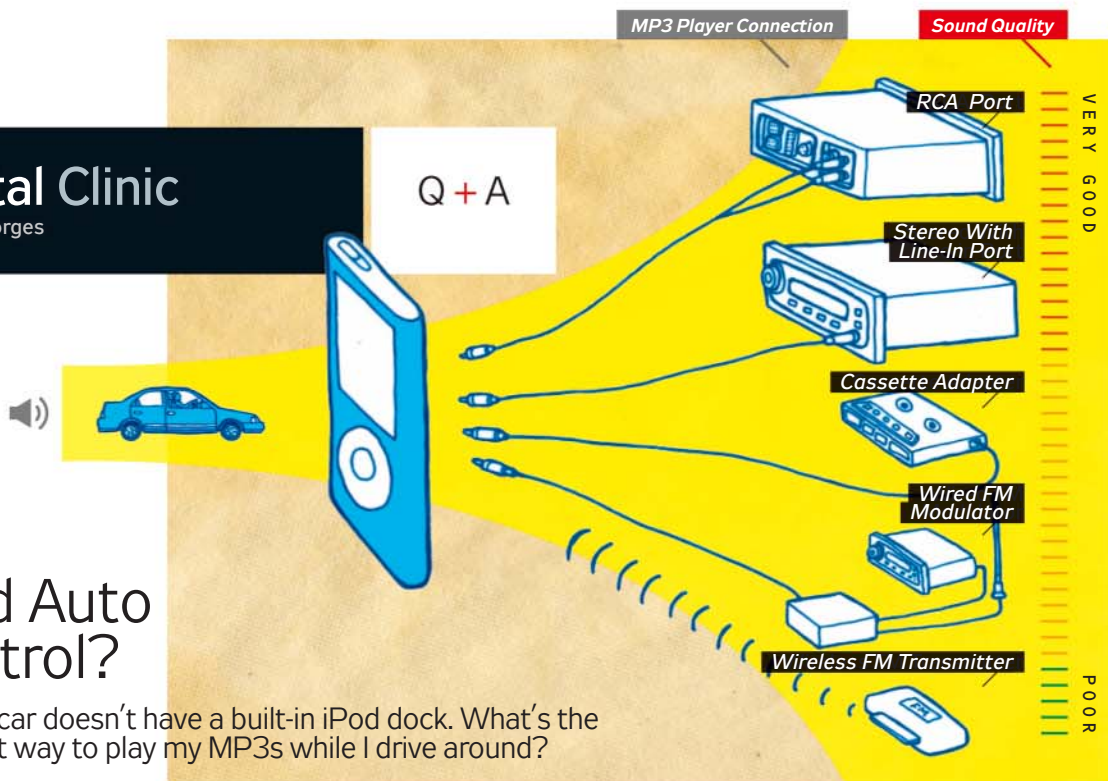
Option 3: Wired FM Modulator

INSTALLATION: **Moderate**

SOUND QUALITY: **Good**

+ With wireless FM transmitters, the signal has to travel through high-traffic airwaves on its way to your car antenna. Wired FM modulators, which usually come as small boxes with a few cords running out from them, intercept the connection between the car's antenna and radio, allowing you to inject your iPod's signal directly into this wired pathway. The result is dramatically improved sound quality—although the final result is still hampered by the limitations of FM radio, which is far from audiophile-friendly.

These modulators are inexpensive (they can be found online for as little as



\$15) and relatively easy to put in, as long as you are comfortable fiddling with your car stereo's wires.

To install one, position yourself underneath the dash. Reach up and unplug the antenna from the back of the stereo and plug it into the modulator's antenna input. Take the modulator's output cord and connect it to the stereo's antenna input. You can then set the modulator to run at any FM frequency. Pick one with weak competing signals (usually at the very top or bottom of the spectrum), and plug the modulator's audio output cord into your iPod's headphone jack.

Option 4: Stereo With Line-In Port

INSTALLATION: **Moderate**

SOUND QUALITY: **Very Good**

+ If you're lucky, your car stereo has a headphone-size line-in port right on the front. If so, all you have to do is jack your MP3 player into this hole, tune your stereo source to "Auxiliary," and

crank some tunes. Unfortunately, most car stereos lack this port. Installing a new car stereo that has one is one method for getting excellent sound using your iPod. New stereos with the port can be purchased for under \$100 and installed either by you or a professional. (Some shops offer free installation with purchase.)

Option 5: RCA Port

INSTALLATION: **Moderate**

SOUND QUALITY: **Very Good**

+ Some car stereos—primarily ones with CD players—include an RCA jack in the back. Hijacking this audio connection from the CD player will provide excellent sound quality for music coming off an iPod. First step: Remove the stereo. If there is an RCA port, you will see dual jacks—one with a red and one with a white input (similar to the RCA jacks on home stereos). RCA-to-headphone cords can be bought for a few dollars at just about any electronics store. Plug the red and white ends of

this cord into the stereo's RCA jack and the other end into your MP3 player's headphone jack. Finally, tune your stereo to either "CD" or "Auxiliary" (the exact setting depends on your stereo).

Frozen Screens

I'm an avid tailgater. Is there any danger in bringing my LCD TV out into the cold? Can the liquid crystals freeze?

Tailgate with confidence. LCD manufacturers regularly test their sets to make sure they can hold up to freezing temperatures. Sony, for example, chills its TVs for a full day at both 14 F and minus 4 F. The findings: While the sets can survive a Green Bay winter without suffering any permanent damage, the cold can cause picture quality to suffer. "At low temperatures, the actual liquid material will move slowly, creating a blurry image," a Sony representative told me. "This will improve once the material warms up." The action on the field may look a bit blurry, but the



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Button Lint

I've had my iPhone for nearly two years. Recently, I've had to press the Home button harder for it to respond, and sometimes have had to try several presses. What's up?

In all likelihood, the culprit is nothing more than simple pocket lint. PM senior technology editor Glenn Derene had a similar problem with his first-generation iPhone. Because his phone was no longer under warranty, having Apple fix or replace it would have cost him about as much as buying a new iPhone 3G. So, once his Home button stopped working almost altogether, Glenn decided to crack open the case and perform diagnosis through dissection. His findings: Seventeen months' worth of lint had

TECH TIP
A sneaky way to brighten your photos.



If a camera has an automatic exposure, its lens acts a lot like a pupil in an eye. That is, its aperture automatically expands when it senses darkness, and contracts if there's an abundance of light. Knowing this, it's easy to manipulate an automatic exposure to let in more light. Simply place your finger over the lens for a few seconds. Sensing darkness, the camera will open up its aperture. As soon as you remove your finger, the aperture will quickly begin to close again. If you snap your shot within about 1 second of moving your finger, the lens will let in more light than usual, and your photo will be extra bright.

drifted under the Home button. Getting to the offending pocket detritus required him to go beyond the kind of reversible surgery that tech-savvy iPhone owners have pioneered over the past year. He actually had to break open parts that were glued together—basically killing the patient. If, like Glenn's, your phone is no longer under warranty, buying a new one may be your only option.

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Dr. Steffanie Seaver PSY.D is an expert in the area of interpersonal relationships. Researcher, author and accomplished public speaker, she has lectured nationwide for over a decade. Dr. Seaver has also been involved with several publications covering relationship and lifestyle issues.

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Jason M.
Manhattan Beach, CA

A: Well Jason,

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Chris Higgins has destroyed more bridges than any flood or earthquake. A structural engineer at Oregon State University's

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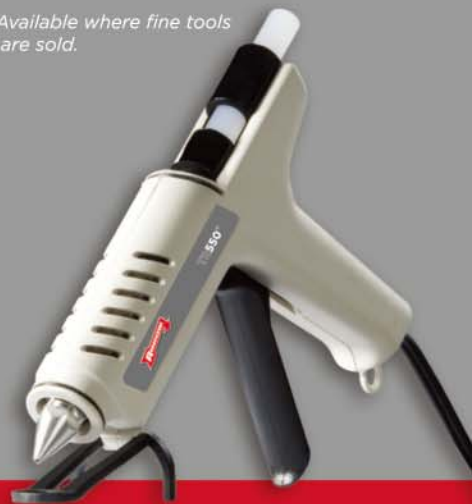
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